SCIENCE:

A WEEKLY RECORD OF SCIENTIFIC PROGRESS.

JOHN MICHELS, Editor.

PUBLISHED AT
229 BROADWAY, NEW YORK.
P. O. Box 3838.

SATURDAY, OCTOBER 30, 1880.

SMYTH'S *Celestial Cycle* in its day was probably the most valuable companion which had at that time been prepared for the use of amateur astronomers. The second volume is known as the *Bedford Catalogue*, and contains an excellent list of the most interesting double stars, nebulæ and clusters, with descriptions, and much other valuable information. When published, this *Catalogue* was received with such favor that the Royal Astronomical Society bestowed upon its author a gold medal. In presenting the medal, the president of the Society, Sir G. B. Airy, called attention to the fact that the original observations upon which the *Catalogue* was based had not been placed at the command of the Society, and hoped that such would be done at no distant period. A careful examination of the *Cycle* now shows that it is full of inaccuracies. Mr. Burnham called attention to these some years ago, but the subject attracted no general attention until a paper by Mr. Herbert Sadler, a member of the Council of the Royal Astronomical Society, appeared in the *Monthly Notices* for January, 1879, in which Mr. Sadler used language which might easily be construed into a charge of dishonesty on the part of Captain Smyth. The words actually used were as follows:

"I have thought it better, therefore, as the charge I have brought against the *Bedford Catalogue* is of a very serious character, to place an asterisk against the symbol of the observer whose erroneous measure Smyth appears to have followed, so that anyone may be able to detect the source of Smyth's error at a glance in cases where he has presumably copied the measures of others."

This criticism raised a perfect storm in the Society.

As Mr. Burnham had originally called attention to the inaccuracies of the *Cycle*, he immediately set to work re-observing the stars of the *Bedford Catalogue*, and has published his results in the June number of the *Monthly Notices*. This paper contains about 350 measures of 148 stars, which he has compared with the measures of Captain Smyth. Mr. Burnham divides these stars into two classes: Those which had and those which had not been carefully measured by any other observer up to the time of the publication of the "Cycle of Celestial Objects;" and concludes that the measures of the former class are in the main correct, while those of the latter class are either roughly approximate or grossly inaccurate; in fact, are not micrometrical measures at all in the usual sense of the term. In explanation of the remarkable character of the "Cycle" measures Mr. Burnham says:

"We know that the observations in the *Bedford Catalogue*, which, so far as the double stars are concerned, could have been easily made in one year, are scattered over a series of years. It may, I think, be fairly assumed that they were made in leisure moments, without that care which a more zealous and experienced observer would bestow; with no definite idea of their publication and use; and as an amusement rather than as a serious astronomical work. If we assume that at the beginning the observer made it a practice, in measuring double stars, of setting the micrometer wires in accordance with the previous measure of other observers, for the purpose of identification, or for some other reason, and with the intention of making such changes in the wires as the appearance of the object seemed to warrant, we have at once a complete explanation of the very close agreement with other measures." This explanation seems reasonable and implies no dishonesty on the part of Captain Smyth.

Immediately following Mr. Burnham's paper is one by Mr. Knobel, who calls attention to the fact that the majority of these so-called measures have a weight 1 assigned, and that Captain Smyth repeatedly asserts that such are mere guesses. Mr. Knobel accounts for many of the discrepancies in position angles by errors in computation.

Both of these interesting papers give a pretty clear insight into the *Bedford Catalogue;* and, although it is undoubtedly true that the principle upon which it secured the medal of the Royal Astronomical Society was a wrong one, as the Astronomer Royal showed at the time of presentation, still in its preparation Captain Smyth performed a useful service, and all lovers of astronomy will be glad to know that Mr. Chambers is preparing a new edition which will embody the progress of astronomy up to 1880.

THE United States Fish Commission has completed its summer's work at the Newport Station, and its parties have returned to Washington. The Fish Hawk, the steamer of the Commission, is now at Wilmington receiving the remainder of its fish-hatching apparatus for use during the winter.

The work has been successful beyond any expectations. Among the acquisitions of three days' work on the edge of the Gulf Stream were fifteen new species of fishes, one hundred and seventy-five species of mollusks, of which one hundred and fifteen were new to southern New England, sixty-five new to America, and thirty or more undescribed. Corresponding acquisitions have been made in other branches of marine zoology.

THE next United States Congress will act on a bill, reported in the last Congress, in support of an International Commission to agree on standard tests for color blindness and standard requirements for visual power in navies and merchant marines. Dr. R. Joy Jeffries, A. M., of 15 Chestnut street, Boston, Mass., will be glad to have public or private statistics or information in relation to this subject.

The attention of those interested in Hygiene reform is directed to the Hygiene Convention and Exhibition of inventions, mechanical contrivances and processes relating to sanitary and household economies to be held at Wellesley, Mass., commencing November 3rd, and ending November the 9th.

A most attractive programme has been arranged, which reflects the highest credit on those who have organized the arrangements. Tickets and programmes can be obtained at the St. Nicholas Hotel, New York; Hotel Wellesley, Wellesley, Mass., or of the Executive Committee, 158 Tremont Street, Boston, Mass.

THE COMETS.

There are now four comets visible with a good telescope, but none of them can be seen with the naked eye. They are all growing fainter, and after a few weeks they will become invisible, even in the most powerful telescopes.

The first is the one discovered by Mr. Schærbele at Ann Arbor, Michigan. This is in the morning sky, and its position for November 4 will be:

A. R. = 5 h. 18.9 m. Decl. South = 7° 33′.

The second is the one discovered by Mr. Hartwig, at Strasburg, Germany; and also, independently, on the next night by Professor Harrington, of Ann Arbor, Michigan. The position of this comet on November 2 will be:

A. R. = 18 h. 21.7 m. Decl. North = 9° 59′.

It is thought by Professor Winnecke that this comet is a return of the one of 1506.

The third is the comet discovered by Mr. Lewis Swift, at Rochester, New York, on October 10. This is a faint object, and its position on November 2 will be nearly as follows:

A. R. = 22 h. 0.0 m. Decl. North 34° 15′.

No orbit of this comet has been computed.

The fourth comet is the one with a period of seven and a third years, and known as Faye's, having been discovered by M. Faye, of Paris, in 1843. The orbit of this comet has been investigated in an admirable manner by Professor Axel Moeller, of Lund, Sweden, and its motion is nearly as well known as that of a planet. The ephemeris furnished by Professor Moeller for the present return is almost exactly correct. The position of this comet for November 2 will be:

A. R. = 22 h. 53.5 m Decl. South = 0° 25′.

Since this comet is always at a great distance from the sun, it is a faint object, even on the most favorable occasions. It will soon be invisible except in the larger telescopes.

Washington, Oct. 28, 1880 A. HALL.

ETHNOLOGY.*

FRAGMENTARY NOTES ON THE ESKIMO OF CUMBERLAND SOUND.

By LUDWIG KUMLIEN.

III.

Since whalers began to cruise in the Cumberland waters, they have found that it is decidedly to their advantage to hire boats' crews of natives to assist in the capture of whales. They make good whalemen. When such crews are secured, they wisely count in all of their family in the bargain, so that to secure the services of a crew of seven men one must feed thirty or more. While working for whalers, the Eskimo depend almost wholly on the ship for their food supply; as a consequence, they are fast becoming poor hunters and prefer to lounge around a vessel and pick up such scraps as offer themselves rather than to strike out for themselves and live independently and in comparative plenty.

As to meals, or regular meal-times, they eat when hungry, if they have anything. They always eat in the morning before going out to hunt; but the principal meal is in the evening, on their return. When supplied with rations by the ships, they often have their regular meals aboard; but this does in no wise hinder them from taking their usual evening allowance of raw meat when they return to their huts.

That the Eskimo possess considerable powers of abstinence cannot be disputed; but it is not so remarkable after all, for they certainly have had ample experience in this direction. That they are able to bear temporary or sustained exertion better than the whites is doubtful. They are acclimated and have clothing suited to the climate, and readily adapt themselves to the rude shelter of a snow-bank, if necessary; but give a healthy white man as good clothes, and he will stand as much fatigue, and perhaps more.

While hunting with the Eskimo, we often had our noses and faces frozen, when the cold did not seem to affect the Eskimo in the least; but when it came to a tramp through the snow all day long, few of them would stand it any better than we could.

Some have judged their powers of endurance from the manner in which they will follow their game; but it seems to us that it is rather their wonderful patience, for we have known them to follow animal tracks for a whole day, when we confess we could not discover the faintest trace of a track, except at long distances apart. They will discover many traces of animals on the snow that a white man would pass by and not notice. When traveling either on the ice or water, they make the journey by short, easy stages, stopping as soon as they feel the least tired, and recruiting; if

*Bulletin (15) of the United States National Museum. Contributed to the Natural History of Arctic America, made in connection with the Howgate Polar Expedition, 1877-78.

THE next United States Congress will act on a bill, reported in the last Congress, in support of an International Commission to agree on standard tests for color blindness and standard requirements for visual power in navies and merchant marines. Dr. R. Joy Jeffries, A. M., of 15 Chestnut street, Boston, Mass., will be glad to have public or private statistics or information in relation to this subject.

The attention of those interested in Hygiene reform is directed to the Hygiene Convention and Exhibition of inventions, mechanical contrivances and processes relating to sanitary and household economies to be held at Wellesley, Mass., commencing November 3rd, and ending November the 9th.

A most attractive programme has been arranged, which reflects the highest credit on those who have organized the arrangements. Tickets and programmes can be obtained at the St. Nicholas Hotel, New York; Hotel Wellesley, Wellesley, Mass., or of the Executive Committee, 158 Tremont Street, Boston, Mass.

THE COMETS.

There are now four comets visible with a good telescope, but none of them can be seen with the naked eye. They are all growing fainter, and after a few weeks they will become invisible, even in the most powerful telescopes.

The first is the one discovered by Mr. Schærbele at Ann Arbor, Michigan. This is in the morning sky, and its position for November 4 will be:

A. R. = 5 h. 18.9 m. Decl. South = 7° 33′.

The second is the one discovered by Mr. Hartwig, at Strasburg, Germany; and also, independently, on the next night by Professor Harrington, of Ann Arbor, Michigan. The position of this comet on November 2 will be:

A. R. = 18 h. 21.7 m. Decl. North = 9° 59′.

It is thought by Professor Winnecke that this comet is a return of the one of 1506.

The third is the comet discovered by Mr. Lewis Swift, at Rochester, New York, on October 10. This is a faint object, and its position on November 2 will be nearly as follows:

A. R. = 22 h. 0.0 m. Decl. North 34° 15′.

No orbit of this comet has been computed.

The fourth comet is the one with a period of seven and a third years, and known as Faye's, having been discovered by M. Faye, of Paris, in 1843. The orbit of this comet has been investigated in an admirable manner by Professor Axel Moeller, of Lund, Sweden, and its motion is nearly as well known as that of a planet. The ephemeris furnished by Professor Moeller for the present return is almost exactly correct. The position of this comet for November 2 will be:

A. R. = 22 h. 53.5 m Decl. South = 0° 25′.

Since this comet is always at a great distance from the sun, it is a faint object, even on the most favorable occasions. It will soon be invisible except in the larger telescopes.

Washington, Oct. 28, 1880 A. HALL.

ETHNOLOGY.*

FRAGMENTARY NOTES ON THE ESKIMO OF CUMBERLAND SOUND.

By LUDWIG KUMLIEN.

III.

Since whalers began to cruise in the Cumberland waters, they have found that it is decidedly to their advantage to hire boats' crews of natives to assist in the capture of whales. They make good whalemen. When such crews are secured, they wisely count in all of their family in the bargain, so that to secure the services of a crew of seven men one must feed thirty or more. While working for whalers, the Eskimo depend almost wholly on the ship for their food supply; as a consequence, they are fast becoming poor hunters and prefer to lounge around a vessel and pick up such scraps as offer themselves rather than to strike out for themselves and live independently and in comparative plenty.

As to meals, or regular meal-times, they eat when hungry, if they have anything. They always eat in the morning before going out to hunt; but the principal meal is in the evening, on their return. When supplied with rations by the ships, they often have their regular meals aboard; but this does in no wise hinder them from taking their usual evening allowance of raw meat when they return to their huts.

That the Eskimo possess considerable powers of abstinence cannot be disputed; but it is not so remarkable after all, for they certainly have had ample experience in this direction. That they are able to bear temporary or sustained exertion better than the whites is doubtful. They are acclimated and have clothing suited to the climate, and readily adapt themselves to the rude shelter of a snow-bank, if necessary; but give a healthy white man as good clothes, and he will stand as much fatigue, and perhaps more.

While hunting with the Eskimo, we often had our noses and faces frozen, when the cold did not seem to affect the Eskimo in the least; but when it came to a tramp through the snow all day long, few of them would stand it any better than we could.

Some have judged their powers of endurance from the manner in which they will follow their game; but it seems to us that it is rather their wonderful patience, for we have known them to follow animal tracks for a whole day, when we confess we could not discover the faintest trace of a track, except at long distances apart. They will discover many traces of animals on the snow that a white man would pass by and not notice. When traveling either on the ice or water, they make the journey by short, easy stages, stopping as soon as they feel the least tired, and recruiting; if

*Bulletin (15) of the United States National Museum. Contributed to the Natural History of Arctic America, made in connection with the Howgate Polar Expedition, 1877-78.

THE next United States Congress will act on a bill, reported in the last Congress, in support of an International Commission to agree on standard tests for color blindness and standard requirements for visual power in navies and merchant marines. Dr. R. Joy Jeffries, A. M., of 15 Chestnut street, Boston, Mass., will be glad to have public or private statistics or information in relation to this subject.

The attention of those interested in Hygiene reform is directed to the Hygiene Convention and Exhibition of inventions, mechanical contrivances and processes relating to sanitary and household economies to be held at Wellesley, Mass., commencing November 3rd, and ending November the 9th.

A most attractive programme has been arranged, which reflects the highest credit on those who have organized the arrangements. Tickets and programmes can be obtained at the St. Nicholas Hotel, New York; Hotel Wellesley, Wellesley, Mass., or of the Executive Committee, 158 Tremont Street, Boston, Mass.

THE COMETS.

There are now four comets visible with a good telescope, but none of them can be seen with the naked eye. They are all growing fainter, and after a few weeks they will become invisible, even in the most powerful telescopes.

The first is the one discovered by Mr. Schærbele at Ann Arbor, Michigan. This is in the morning sky, and its position for November 4 will be:

A. R. = 5 h. 18.9 m. Decl. South = 7° 33′.

The second is the one discovered by Mr. Hartwig, at Strasburg, Germany; and also, independently, on the next night by Professor Harrington, of Ann Arbor, Michigan. The position of this comet on November 2 will be:

A. R. = 18 h. 21.7 m. Decl. North = 9° 59′.

It is thought by Professor Winnecke that this comet is a return of the one of 1506.

The third is the comet discovered by Mr. Lewis Swift, at Rochester, New York, on October 10. This is a faint object, and its position on November 2 will be nearly as follows:

A. R. = 22 h. 0.0 m. Decl. North 34° 15′.

No orbit of this comet has been computed.

The fourth comet is the one with a period of seven and a third years, and known as Faye's, having been discovered by M. Faye, of Paris, in 1843. The orbit of this comet has been investigated in an admirable manner by Professor Axel Moeller, of Lund, Sweden, and its motion is nearly as well known as that of a planet. The ephemeris furnished by Professor Moeller for the present return is almost exactly correct. The position of this comet for November 2 will be:

A. R. = 22 h. 53.5 m Decl. South = 0° 25′.

Since this comet is always at a great distance from the sun, it is a faint object, even on the most favorable occasions. It will soon be invisible except in the larger telescopes.

Washington, Oct. 28, 1880 A. HALL.

ETHNOLOGY.*

FRAGMENTARY NOTES ON THE ESKIMO OF CUMBERLAND SOUND.

By LUDWIG KUMLIEN.

III.

Since whalers began to cruise in the Cumberland waters, they have found that it is decidedly to their advantage to hire boats' crews of natives to assist in the capture of whales. They make good whalemen. When such crews are secured, they wisely count in all of their family in the bargain, so that to secure the services of a crew of seven men one must feed thirty or more. While working for whalers, the Eskimo depend almost wholly on the ship for their food supply; as a consequence, they are fast becoming poor hunters and prefer to lounge around a vessel and pick up such scraps as offer themselves rather than to strike out for themselves and live independently and in comparative plenty.

As to meals, or regular meal-times, they eat when hungry, if they have anything. They always eat in the morning before going out to hunt; but the principal meal is in the evening, on their return. When supplied with rations by the ships, they often have their regular meals aboard; but this does in no wise hinder them from taking their usual evening allowance of raw meat when they return to their huts.

That the Eskimo possess considerable powers of abstinence cannot be disputed; but it is not so remarkable after all, for they certainly have had ample experience in this direction. That they are able to bear temporary or sustained exertion better than the whites is doubtful. They are acclimated and have clothing suited to the climate, and readily adapt themselves to the rude shelter of a snow-bank, if necessary; but give a healthy white man as good clothes, and he will stand as much fatigue, and perhaps more.

While hunting with the Eskimo, we often had our noses and faces frozen, when the cold did not seem to affect the Eskimo in the least; but when it came to a tramp through the snow all day long, few of them would stand it any better than we could.

Some have judged their powers of endurance from the manner in which they will follow their game; but it seems to us that it is rather their wonderful patience, for we have known them to follow animal tracks for a whole day, when we confess we could not discover the faintest trace of a track, except at long distances apart. They will discover many traces of animals on the snow that a white man would pass by and not notice. When traveling either on the ice or water, they make the journey by short, easy stages, stopping as soon as they feel the least tired, and recruiting; if

*Bulletin (15) of the United States National Museum. Contributed to the Natural History of Arctic America, made in connection with the Howgate Polar Expedition, 1877-78.

they were required to walk a given distance, as on a regular march, they would give out.

The Cumberland Eskimo are known to make better and more beautiful clothing than the tribes of Northern Hudson's Bay and Straits. During the summer, and, in fact at all seasons, except when the weather is very severe, the outer garment of the men is made from the skins of adult—or, more properly speaking, yearlings, as they are the best—*Pagomys fœtidus*. In very cold weather, they betake themselves to deer-skin clothing; but as these clothes are less strong than the sealskin, they make the change as soon as the weather permits. The women wear the deer-skin clothes much later in the season than the men; their dress is also made of the same kind of seal, unless they are fortunate enough to procure *Collocephalus vitulinus*, which skins are so highly prized that they use them even though there is only sufficient for a part of the fronts of their jackets.

Both the men and women wear a garment the exact duplicate in shape under the outer one; this garment is made either from the young seal in the white coat or of reindeer.

The coat of the men does not open in front, but is drawn on over the head like a shirt, and has a hood that fits the head snugly, while the woman's hood is large and loose, and the jacket is quite loose-fitting, so as to receive the child, which is always carried in the hood. The woman's jacket further differs from the men's in being shorter in front, and ending in a rounded point, while behind it reaches quite to the ground in the form of a lance-shaped train. This appendage is caught up in the same manner as the fashionable train of the present day among civilized nations, when the condition of the ground is unfavorable for its trailing. After all, is not this fashion borrowed from the Eskimo? There is often an approach towards this prolongation in the men's jackets, especially when made of deer skin, but never so long as on the woman's. Neither do little girls have a long train to the jacket; but as soon as they arrive at the age when they are no longer looked upon as children, they learn to imitate their mothers. There are never any pockets in the jackets of either sex, the hood serving for this purpose.

The pants of the men are made from the same material as the coat, with the exception that the young seal in the white coat is often used for the outer as well as the inner garment. The pants reach only to the upper part of the pelvis, and are kept up by means of a string around the body. They reach a little below the knee, where they are met by the boots. When made of deer skin, they are usually ornamented by fringes of cut skin around the lower edges.

The women's pants differ from the men's in being composed of two separate pieces, the lower reaching from a little below the knee to the middle of the thigh, and are kept in place by a string which runs to the upper edge of the other portion. The lower portion of these pantaloons is removed while they are at work in their igloos, and the bare thigh used, as a board would be, to lay the seal skin on while cleaning the blubber from it. The women have the habit of thrusting their hands between the upper and lower pantaloons the same as we do in a pocket; in fact, they use this space as a sort of pocket.

Little girls wear their breeches like the men till they get to be ten or twelve years of age. Very small children are dressed in a fawn-skin jacket without attached hood; but their heads are, nevertheless, well bundled up in a double fawn-skin hood that fits the scalp closely. This hood is never removed, except perchance by accident, till the child outgrows it. The lower extremities are usually not clad at all.

The children are carried *on* the mother's back inside her jacket. The cut of the jacket is such that the child goes down as far as the mother's waist, when the closeness of the jacket prevents it going any farther. The hood allows the child freedom for its arms and head, but the legs are cramped underneath its body, and this is probably one cause of bow-leggedness and possibly the shortness of the lower extremities. I have seen the Eskimo mother, with a child fast asleep in her hood, building a toopik. This work often necessitated her stooping over so much as to seemingly endanger the dumping of the infant over her head on the ground; still, it did not seem to inconvenience the child in the least as it slept soundly through the whole proceeding.

The *kámik*, or, as generally pronounced, *kumming*, or boots, are principally made from the skins of adult *Pagomys fœtidus*, with the hair off, the soles being made from the skin of *Phoca barbata*. For Winter wear a very beautiful and serviceable boot is made from the skin of reindeer legs sewed together lengthwise; they are used only in dry snow, being quite useless when the snow is wet. Another style of boot is to have the leg of netsick skin, but with the hair on. These boots reach nearly to the knee, and are kept in place by means of a string around the top, and also secured by a seal-skin cord passing over the instep and around the heel. They are generally sewed with sinews from reindeer; but for boots the sinews from the dorsal vertebræ of *Beluga catodon* are preferred when they can be procured.

The stocking worn next to the foot is of heavy reindeer skin, the hair side next the foot; they reach above the knee. Over the stocking is worn a sort of slipper made from the eider-duck. The bird is skinned by making an incision on the back near one wing; through this opening the body is removed. The skin is cleaned of the fat by the Eskimo's teeth, and the skin farther prepared by chewing it. The tail-feathers are removed, and this end becomes the toe of the slipper, the feather side being worn inside. Its upper edges are bound with some kind of skin to give it additional strength, and if the entire slipper is covered with cloth will last a long time. They are very warm and comfortable. *Larus glaucus* is often used for this purpose. For children they use *Uria grylle* and *Rissa tridactylus* skins. Over all this is worn another slipper made from the netsick skin, with the hair on, and the hair side worn outward and the hair pointing from the toe backwards. This very much facilitates the drawing on of the boot.

For summer wear the young of the netsick in the woolly coat is substituted for reindeer for the stockings. Dog skin is also sometimes used for stockings, but not so commonly among the Cumberland Eskimo as among those of Hudson's Straits, who use dog skins for pants as well as stockings.

All the clothing is sewed with sinews, reindeer or white whale. The reindeer sinews are dried in bulk as they come from the animal, and are split off as needed. The fibres are separated as fine as necessary, and then drawn quickly between the teeth to secure a more uniform size. The women all sew towards themselves, using the thimble on the first finger; they seldom use but one kind of seam: the edges of the skin are carefully matched together, and joined by sewing over and over the overcast seam. Their thimbles (called *tikik*, also signifies first finger) are made from the skin of *Phoca barbata;* in shape they are merely an oblong piece sufficiently large to cover the point of the finger; a rim is cut around the outside edge for about one-half its length; this forms a sort of loop under which the finger is passed, and in this manner it is kept in place. We found this style of thimble much more convenient than the metal one of the usual form.

Very few of the Cumberland Eskimo at the present day use anything but steel needles, or bone ones made after the same pattern. We have seen an instrument said to have been used as a needle that is considerably different from anything we ever saw before. An Eskimo brought it to us and wanted a hatchet in exchange. We thought it certain he would return and offer to trade at our terms; but he did not, and we never saw him again. This tool was almost exactly like an awl in shape, but had an *eye* near the point. They must have had to thread this instrument for every stitch. The needle part was apparently of deer horn and the handle of walrus ivory.

The favorite and principal tool of the women is a knife shaped like an ordinary mincing-knife. Nearly all the Cumberland Eskimo have now procured iron enough from some source or other so that they can have an iron knife of this pattern. Before they could procure enough iron they made the knife of ivory, and merely sank flakes or pieces of iron into the edge, in the same manner as the natives of North Greenland do at the present time. This same practice of sinking iron flakes into the edge was also used on their large skinning knives, which were made from a walrus tusk, and much after the pattern of an ordinary steel butcher-knife. Some of these ivory knives have no iron in them; but at the present time they are used principally, if not entirely, for cutting snow and removing ice from their kyacks.

The women seldom use any other kind of knife than such as just described. With them they remove the blubber from the skins, split skins, cut up meat, and, when sewing, this instrument is used instead of scissors. They begin a garment by sewing together two pieces of skin and shaping them as they go along by means of the knife, cutting for an inch or two and then sewing. They always *push* the knife *from* them when working it.

Tattooing does not seem to be as prevalent now as formerly, for it is mostly on the aged women that one finds it at present. The markings resemble India ink in appearance, and are done with gunpowder at present. Still, some use the old method, by taking the juice of *Fucus vesiculosus*, L. (or a closely allied species) and some small algæ that apparently contain a good deal of iodine, and mixing with lampblack.

Instances came under our observation of people of apparently great age—say seventy years and over, to judge from appearances; they had gray hair (a rare thing among the Eskimo), and were nearly blind; the women had the teeth worn close to the gums by chewing skins.

It is impossible to arrive at any definite conclusion regarding their age, as they keep no record of time, and can not refer to any past event by any means of notation. We could not learn of the rudest attempt at picture-writing or hieroglyphics; and, as they possess no records whatever, their traditions are handed down from generation to generation without being fixed by any means which allow even an approximate estimate of their growth and prosperity.

Most of them are unable to count beyond their ten fingers, and many are unable to go over six; some, again, are said to have names for numbers to twenty, but they are few. The numerals are differently pronounced, and we found difficulty in getting one sufficiently conversant with them to give us the numerals to ten.

One =*Atáusa*, or *atausat.*
Two = *Mácho.*
Three = *Píngasuit*, or *píngasat.*
Four = *Séseminé*, or *sesemat.*
Five = *Tódlimené*, or *tódlimát.*
Six=*Aúkbinigan.*
Seven=*Pingashuing* (?).
Eight=*Aukbinigan-machoni* (6 and 2).
Nine=*Schischimani* (? ?).
Ten=*Kowolin.*

Above ten they are said to count their toes and take ten and one, ten and two, &c.; but we were unable to find one who knew their names. They will tell you they have caught seals or birds up to six, but if more they generally put it *amashuadly* (a good many), which may be any number from seven upwards.

In the treatment of the sick they are very superstitious, and in fact they resort almost entirely to their *ancoot*, *angekoks*, or medicine men.

The following is a Greenlander's legend that proposes to give a reason why people die: "The cause of people's dying is laid to a woman, said to have discoursed thus: 'Let the people die gradually, otherwise they will not have room in the world.'"

Others relate it in this manner: "Two of the first people quarreled. One said: 'Let it be day and let it be night, and let the people die.' The other said: 'Let it only be night and not day, and let the people live. After a long wrangle it came to pass as the first had said."

It is interesting that this same curious legend exists among the Eskimo of Cumberland Sound; they say though that "those who quarreled finally arranged matters and had both *entire* day and *entire* night at the different seasons, so that both parties might be suited."

The lungs of *Lepus glacialis* are considered as a sure cure for boils and all manner of sores; they draw, they say, and their manner of applying them is the same as we would a poultice. They must be

applied as soon after the animal's death as possible, and while they are yet warm.

In cases of scurvy they never use *Cochliaria*, but the stomach of a freshly killed reindeer, with the vegetable contents, instead. If the scurvy patient be very bad, the limbs are bound with pieces of the deer's stomach, whale or seal's blubber, or any kind of fresh meat. If a whale can be caught at such a time, the patient is sometimes bodily shoved into the carcass, or the lower extremities only are sunken into the flesh.

The most prevalent disease among them seems to be lung disease; it is alarmingly common; and consumption probably kills more than all other diseases combined.

The whalemen have introduced venereal diseases among them, which have spread at a terrible rate, and devastate the natives almost like a pest.

I could not learn that they have any knowledge of the medical properties of any plant or shrub. Some of the coarser kinds of *algæ* are procured at low tide from the cracks in the ice, and eaten raw, but only because they are fit to eat, they say; the roots of *Pedicularis* are also sometimes eaten.

When the women are about to be confined they are placed in a small snow-hut, if it be winter, and in a little skin tent, if summer, by themselves. Their only attendant is a little girl, who is appointed by the head *ancoot* of the encampment. A little raw meat—deer, if they have it—is put into the hut with her, and she is left to give birth to the child as best she can. The reason she is removed from her tent is, that should mother or child die in the tent nothing pertaining to the equipment of the establishment could ever be used again, not even the tent-covering or the husband's hunting-gear. In some instances they are obliged to modify this custom somewhat. We have known them to cut the tent-cover about two feet from ground all around and use the upper portion. A man's wife accidentally shot herself in her igloo, but the gun was too great a sacrifice; he used it, but the rest of his household effects were left to waste away where they lay. We knew of another instance where the tent-poles were brought into use again in the course of a year after a death had occurred beneath them.

As soon as the mother with her new-born babe is able to get up and go out, usually but a few hours, they are taken in charge by an aged female *ancooi*, who seems to have some particular mission to perform in such cases. She conducts them to some level spot on the ice, if near the sea, and begins a sort of march in circles on the ice, the mother following with her child on her back; this manœuvre is kept up some time, the old woman going through a number of performances the nature of which we could not learn, and continually muttering something equally unintelligible to us.

The next act is to wade through snow-drifts, the aged *ancoot* leading the way. We have been informed that it is customary for the mother to wade thus bare-legged, but (whether from modesty or the temperature of —50° F. we cannot say) on some occasions this part of the performance is dispensed with.

When a sick person gets so far gone that they deem recovery improbable, he is removed from the hut, and either dragged out upon the rocks to die, or a little snow shelter may be constructed for him, and some scraps of raw meat thrown in to him. Usually such proceedings are apt to end fatally to the patient, even though his ailment might not have been so dangerous had proper care been taken. We know of one instance where a man was thus put out to die seven different times; but he recovered and crawled back to his igloo, and looks now as if he was good for a number of years yet. Stories are common of how aged and infirm people are put out of the way by the younger ones, to rid themselves of a useless burden; but of this we know nothing from personal observations, or from reliable sources.

Occasional instances of suicide happen, generally when the person is afflicted with some incurable disease. Hanging seems to be the favorite mode of killing themselves.

The *ancoot's* manner of operating is various, and almost every one has some method peculiar to himself. We could get but a glimpse of some of them, as they are averse to having a white man witness their performances, and we had the greatest difficulty in getting any one to explain to us their meaning. The following legend is supposed to give the directions for becoming an *ancoot;* it is interesting that this legend does not differ essentially from the Greenlander's. (*Vide* Grœnlands nye Perlustration, Eller Naturel-Historie, Hans Egede, 1741.)

We would here add that those who become *ancoots* are only such as are naturally possessed of a more penetrating mind than their fellows, generally the biggest rascals in the encampment, who seldom pay any attention to what is right or just, but ply their vocation so as to win for themselves renown among their fellows, and possess themselves of any coveted article as remuneration for their services.

Any one wishing to become an *ancoot* must go away a long distance from where there is any other person. Then he must find a large stone, and seat himself by it, and call on *Torngarsuk.** This spirit will then make himself present to him. The would-be *ancoot* will at first be very much frightened at the arrival and appearance of this spirit, so much so that he is seized with severe pains, and falls down and dies, and remains dead for three days. Then he comes to life again, and returns home a very wise man.

An *ancoot's* duty is, first, to mutter over the sick, that they may become well again; secondly, he will talk with *Torngarsuk*, and get information from him as to how he must manage so that they will have success in their undertakings; thirdly, of him he learns if any one is about to die, and what the cause is, or if some unusual death or misfortune is about to occur to the people.

Their devotion and belief in the *ancoots* are unlimited; they can never be induced to trespass on the commands or disbelieve the prophecies of these important personages. When one has been a very suc-

* *Torngarsuk* of the natives of South Greenland, and *Tornarsuk* of North Greenland, is the highest oracle, the master spirit of these people. There are many spirits of less power, called *Tornæt;* these can be seen only by the *angekoks*, after their meeting with *Torngarsuk*. It appears that this word signifies the greatest spirit of Good, as well as of Evil. They now call the Devil *Torngarsuk*, and in their ancient beli f their God, so to speak, the same.

cessful *ancoot* for a long time he may become a great *ancoot;* this necessitates a period of fasting, and then, as the story goes, an animal they call *amarook* (the same word is used for wolf, and for an animal which is probably mythical, unless it can be a *Gulo*) comes into his hut and bites the man, who immediately falls to pieces; his bones are then conveyed to the sea, where he lives for some time as a walrus; he finally returns among his people, a man in appearance, but a God in power.

If the prophecy of an *ancoot* does not come to pass as he had said it would, any phenomenon of nature, as a halo, corona, aurora, etc., is sufficient to have broken the spell, and the *ancoot* loses nothing of his reputation by the failure, for it is then believed that the measure, whatever it might have been, was not pleasing to *Torngarsuk*.

The people come to these soothsayers after all manner of information. We knew of one case where a young woman asked an *ancoot* if her yet unborn child would be a boy or girl. He retired outside the hut for a few moments, and when he returned he said it would "be a boy"; but he adds, "If it is not a boy, it will be a girl"! For this valuable information he charged three seal skins and a knife. As a general thing, the *ancoots* are paid according to their reputation; still, it is very seldom they refuse to give them what they ask for in return for their valuable services.

They seem to have an idea of a future state, but what we denominate as the region down below they consider as the best place. In Egede's "Grœnlands nye Perlustration, year 1741," is given a legend which is almost exactly the same as one that is found among the Cumberland Eskimo at the present day. But Egede says, in the Danish translation, "Himmel," heaven, as though this was the equivalent for the Greenlander's word; the Eskimo of Cumberland say "topani," which means simply "up." They do not distinguish any difference in the soul's condition after death, or rather of the two places where they expect to live hereafter; one differs from the other only in this wise, that if death is caused by certain means they go to the one, and if they die a natural death they go to the other.

The following is their idea of the future: "In the spirit-land *all* will have it as good or better than they had it on earth." Yet they designate two places where the soul goes after death, viz: "Some go up; others far down into the earth." But the lower place is considered preferable. This is described as a beautiful land, with everlasting sunshine, where the seal and reindeer abound in fabulous quantities, and food is consequently abundant. To this latter place go only such as are killed by other Eskimo, women who die in child-birth, such as drown in *salt* water, and *whalers;* they think, this being the better place, it is a sort of recompense for the suffering they underwent on earth; all the rest go up.

In this connection, we will mention that the Cumberland Eskimo think the *aurora borealis* is the spirits of dead Eskimo dancing and having a good time generally. It has even considerable influence over them, and they are well pleased to see a bright *aurora*. The Greenlanders, on the other hand, say it is the spirits of dead Eskimo *fighting*.

MULTIPLE SPECTRA[1]

III.

I have endeavored to show in the previous articles that there are many facts which justify the conclusion that the same elementary substance in a state of purity can under different conditions give us spectra different in kind. To those spectra to which special reference is now made the names of *lined* and *fluted* have been given to mark their chief point of difference, which is that in lined spectra we deal with lines distributed irregularly over the spectrum; while in fluted spectra we deal with rythmical systems.

This was the first point, and I showed that the idea was suggested that the lined and fluted spectra, though produced by the same substance, were produced by that substance in a different molecular condition.

I have pointed out that both in lined and fluted spectra taken separately there was evidence of still further complication, that is, that a complete lined spectrum of a substance and a complete fluted spectrum of a substance, was the result of the vibration not of one kind of molecule only, but probably of several.

So that in this view we have to imagine a series, in some cases a long series, of molecular simplifications brought about by the action of heat, and ascribe the spectral changes to these simplifications.

To understand my contention, and one objection which has been taken to it, in the clearest way, let us suppose that there is a substance which gives us, under different conditions, three spectra, which we will term *a*, *b*, and *c*. My view is that these spectra are produced by three distinct molecular groupings brought about by successive dissociations. On the other hand, it is objected that they are produced by *one and the same molecule* struck, as a bell might be struck, *in different ways* by the heat waves or the electric current passing among the molecules.

In my memoir entitled "Discussion of the Working Hypothesis that the so-called Elements are Compound Bodies," I remarked as follows:—

"I was careful at the very commencement of this paper to point out the fact that the conclusions I have advanced are based upon the analogies furnished by those bodies which, by common consent and beyond cavil and discussion, are compound bodies. Indeed, had I not been careful to urge this point, the remark might have been made that the various changes in the spectra to which I shall draw attention are not the results of successive dissociations, but are effects due to putting the same mass into different kinds of vibration or of producing the vibration in different ways. Thus the many high notes, both true and false, which can be produced out of a bell with or without its fundamental one, might have been put forward as analogous with those spectral lines which are produced at different degrees of temperature with or without the line, due to each substance when vibrating visibly with the lowest temperature. To this argument, however, if it were brought forward, the reply would be that it proves too much. If it demonstrates that the *h* hydrogen line in the sun is produced by the same molecular groupings of hydrogen as that which gives us two green lines only when the weakest possible spark is taken in hydrogen inclosed in a large glass globe, it also proves that calcium is identical with its salts. For we can get the spectrum of any of the salts alone without its common base, calcium, as we can get the green lines of hydrogen without the red one.

"I submit, therefore, that the argument founded on the over-notes of a sounding body, such as a bell, cannot be urged by any one who believes in the existence of any compound bodies at all, because there is no spectroscopic break between acknowledged compounds and the supposed elementary bodies. The spectroscopic differences between calcium itself at different temperatures is, as I shall show, as great as when we pass from known compounds of calcium to calcium itself. There is a perfect continuity of phenomena from one end of the scale of temperature to the other."

Not only is what may be termed the bell hypothesis op-

[1] Continued from p. 107.

cessful *ancoot* for a long time he may become a great *ancoot;* this necessitates a period of fasting, and then, as the story goes, an animal they call *amarook* (the same word is used for wolf, and for an animal which is probably mythical, unless it can be a *Gulo*) comes into his hut and bites the man, who immediately falls to pieces; his bones are then conveyed to the sea, where he lives for some time as a walrus; he finally returns among his people, a man in appearance, but a God in power.

If the prophecy of an *ancoot* does not come to pass as he had said it would, any phenomenon of nature, as a halo, corona, aurora, etc., is sufficient to have broken the spell, and the *ancoot* loses nothing of his reputation by the failure, for it is then believed that the measure, whatever it might have been, was not pleasing to *Torngarsuk*.

The people come to these soothsayers after all manner of information. We knew of one case where a young woman asked an *ancoot* if her yet unborn child would be a boy or girl. He retired outside the hut for a few moments, and when he returned he said it would "be a boy"; but he adds, "If it is not a boy, it will be a girl"! For this valuable information he charged three seal skins and a knife. As a general thing, the *ancoots* are paid according to their reputation; still, it is very seldom they refuse to give them what they ask for in return for their valuable services.

They seem to have an idea of a future state, but what we denominate as the region down below they consider as the best place. In Egede's "Grœnlands nye Perlustration, year 1741," is given a legend which is almost exactly the same as one that is found among the Cumberland Eskimo at the present day. But Egede says, in the Danish translation, "Himmel," heaven, as though this was the equivalent for the Greenlander's word; the Eskimo of Cumberland say "topani," which means simply "up." They do not distinguish any difference in the soul's condition after death, or rather of the two places where they expect to live hereafter; one differs from the other only in this wise, that if death is caused by certain means they go to the one, and if they die a natural death they go to the other.

The following is their idea of the future: "In the spirit-land *all* will have it as good or better than they had it on earth." Yet they designate two places where the soul goes after death, viz: "Some go up; others far down into the earth." But the lower place is considered preferable. This is described as a beautiful land, with everlasting sunshine, where the seal and reindeer abound in fabulous quantities, and food is consequently abundant. To this latter place go only such as are killed by other Eskimo, women who die in child-birth, such as drown in *salt* water, and *whalers;* they think, this being the better place, it is a sort of recompense for the suffering they underwent on earth; all the rest go up.

In this connection, we will mention that the Cumberland Eskimo think the *aurora borealis* is the spirits of dead Eskimo dancing and having a good time generally. It has even considerable influence over them, and they are well pleased to see a bright *aurora*. The Greenlanders, on the other hand, say it is the spirits of dead Eskimo *fighting*.

MULTIPLE SPECTRA[1]

III.

I have endeavored to show in the previous articles that there are many facts which justify the conclusion that the same elementary substance in a state of purity can under different conditions give us spectra different in kind. To those spectra to which special reference is now made the names of *lined* and *fluted* have been given to mark their chief point of difference, which is that in lined spectra we deal with lines distributed irregularly over the spectrum; while in fluted spectra we deal with rythmical systems.

This was the first point, and I showed that the idea was suggested that the lined and fluted spectra, though produced by the same substance, were produced by that substance in a different molecular condition.

I have pointed out that both in lined and fluted spectra taken separately there was evidence of still further complication, that is, that a complete lined spectrum of a substance and a complete fluted spectrum of a substance, was the result of the vibration not of one kind of molecule only, but probably of several.

So that in this view we have to imagine a series, in some cases a long series, of molecular simplifications brought about by the action of heat, and ascribe the spectral changes to these simplifications.

To understand my contention, and one objection which has been taken to it, in the clearest way, let us suppose that there is a substance which gives us, under different conditions, three spectra, which we will term *a*, *b*, and *c*. My view is that these spectra are produced by three distinct molecular groupings brought about by successive dissociations. On the other hand, it is objected that they are produced by *one and the same molecule* struck, as a bell might be struck, *in different ways* by the heat waves or the electric current passing among the molecules.

In my memoir entitled "Discussion of the Working Hypothesis that the so-called Elements are Compound Bodies," I remarked as follows:—

"I was careful at the very commencement of this paper to point out the fact that the conclusions I have advanced are based upon the analogies furnished by those bodies which, by common consent and beyond cavil and discussion, are compound bodies. Indeed, had I not been careful to urge this point, the remark might have been made that the various changes in the spectra to which I shall draw attention are not the results of successive dissociations, but are effects due to putting the same mass into different kinds of vibration or of producing the vibration in different ways. Thus the many high notes, both true and false, which can be produced out of a bell with or without its fundamental one, might have been put forward as analogous with those spectral lines which are produced at different degrees of temperature with or without the line, due to each substance when vibrating visibly with the lowest temperature. To this argument, however, if it were brought forward, the reply would be that it proves too much. If it demonstrates that the *h* hydrogen line in the sun is produced by the same molecular groupings of hydrogen as that which gives us two green lines only when the weakest possible spark is taken in hydrogen inclosed in a large glass globe, it also proves that calcium is identical with its salts. For we can get the spectrum of any of the salts alone without its common base, calcium, as we can get the green lines of hydrogen without the red one.

"I submit, therefore, that the argument founded on the over-notes of a sounding body, such as a bell, cannot be urged by any one who believes in the existence of any compound bodies at all, because there is no spectroscopic break between acknowledged compounds and the supposed elementary bodies. The spectroscopic differences between calcium itself at different temperatures is, as I shall show, as great as when we pass from known compounds of calcium to calcium itself. There is a perfect continuity of phenomena from one end of the scale of temperature to the other."

Not only is what may be termed the bell hypothesis op-

[1] Continued from p. 107.

posed to the law of continuity, as I endeavored to show in the last paragraphs quoted, but it appears never to have struck the objectors that it is also opposed to the theory of exchanges as it is generally enunciated, on which the whole of our supposed knowledge of extra-terrestrial matter depends. If vapors, when relatively cool, do not absorb the same wave-lengths which they give out when relatively hot, what becomes of some of the most noted exploits of our nineteenth-century science?

Take the case of sodium. Three distinct spectra have been mapped for it. There is first the yellow line seen in a Bunsen flame, then the green line seen alone in a vacuum tube when the vapor is illuminated by an electric glow, and again there is the fluted absorption spectrum, without any lines, seen when sodium is gently heated in hydrogen in a glass tube. If we have here the same molecule agitated in different ways, I ask which is the true spectrum of sodium? And what right have we to say that sodium exists in the sun because the yellow line is represented? Why do we not rather say that sodium does *not* exist in the sun because the fluted spectrum is *not* represented.

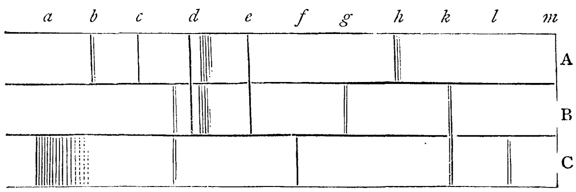

FIG. 1.—A. Highest temperature. C. Lowest temperature.

It is not necessary to enlarge upon this point because the difficulty in which the theory of exchanges is thus landed is obvious, while, if we acknowledge different molecular groupings in the vapors of the same chemical substance, and apply the theory of exchanges *to each grouping*, then the teachings of that theory become more numerous and important than before.

It is of course of the highest importance to see whether there is any *experimentum crucis*—any mode of inquiry—by which the theory can be settled one way or the other.

I submit that the results of experiments based on the following considerations ought to be accepted as throwing light on the question.

1. At different temperatures the brilliancy of the spectral lines of the same substances as ordinarily observed changes enormously. See if these changes can be produced *at the same temperature* by employing those experimental conditions which will be most likely to bring about different molecular conditions if such exist.

2. At a low temperature some substances give us few lines while at a high one they give us many. Vapors, therefore, already glowing with full lines at a low temperature, say in a flame, should give us all their lines when the vapor is suddenly subjected to a high one, say by the passage of a high tension spark. On the bell hypothesis the spectrum should change with the mode of striking. On the dissociation hypothesis this should only happen for the lines of those molecular groupings which are *from other considerations* held to be more simple. If the flame has brought the substance to its lowest state, the passage of the most powerful spark should not cause the flame spectrum to vary.

Now what are the "other considerations" above referred to? This necessitates a slight digression.

In the *Phil. Trans.* for 1873[1] I gave an historical account, showing how, when a light source such as a spark or an electric arc is made to throw its image on the slit of a spectroscope, the lines had been seen of different lengths, and I also showed by means of photographs how very definite these phenomena were. It was afterwards demonstrated that for equal temperatures chemical combination or mechanical mixture gradually reduced the spectrum by subtracting the shortest lines, and leaving only the long ones.

On the hypothesis that the elements were truly elementary, the explanation generally given and accepted was that the short lines were produced by a more complex vibration imparted to the "atom" in the region of greatest electrical excitement, and that these vibrations were obliterated, or prevented from arising, by cooling or admixture with dissimilar "atoms."

Subsequent work, however, has shown[1] that of these short lines *some* are common to two or more spectra. These lines I have called basic. Among the short lines, then, we have some which are basic, and some which are not.

The different behavior of these basic lines seemed, therefore, to suggest *that not all of the short lines of spectra were, in reality, true products of high temperature.*

That some would be thus produced and would therefore be common to two or more spectra we could understand by appealing to Newton's rule: "Causas rerum naturalium non plures admitti debere quam quæ et varæ sint et earum phænomenis explicandis sufficiant," and imagining a higher dissociation. It became, however, necessary to see if the others would also be accounted for.

Now if not all but only *some* of the short lines are products of high temperature, we are bound to think that the *others* are remnants of the spectra of those molecular groupings first to disappear on the application of heat.

At any particular heat-level, then, some of the short lines may be due to the vibrations of molecular groupings produced with difficulty by the temperature employed, while others may represent the fading out of the vibrations of other molecular groupings, produced on the first application of the heat.

In the line of reasoning which I advanced a year ago,[2] both these results are anticipated, and are easily explained. Slightly varying Fig. 2 of that paper, we may imagine furnace A to represent the temperature of the jar spark, B that of the Bunsen burner, and C a temperature lower than that of the Bunsen burner (Fig. 1.)

Then in the light of the paper the lines *b* and *c* would be truly produced by the action of the highest temperature, *c* would be short and might be basic, while of the lines *h* and *m*, *m* would be short and could not be basic, because it is a remnant of the spectrum of a lower temperature.

So much then by way of explanation; it is clear that to make this reasoning valid we must show that the spark, or better still the arc, provides us with as ummation of the spectra of various molecular groupings into which *the solid metal which we use as poles* is successively broken up by the action of heat.

We are not limited to solid metals; we may use their salts. In this case it is shown in the paper before referred to[3] that in very many cases the spectrum is one much less rich in lines.

The experimental work has followed two distinct lines. I shall refer somewhat in detail to the results obtained along each. The first relates to the extraordinary and beautiful phenomena and changes observed in the spectra of vapors of the elementary bodies when volatilized at different temperatures in vacuum tubes. Many of the lines thus seen alone and of surpassing brilliancy, are those seen as short and faint in ordinary methods of observation, and the circumstances under which they are seen suggest, if we again apply Newton's rule, that many of them are produced by complex molecules.

In this case the appeal lies to the phenomena produced when organic bodies are distilled at varying temperatures; the simplest bodies in homologous series are those volatilized at the lowest temperatures; so that on subjecting a mixture of two or more liquids to distillation, at the beginning a large proportion of the more volatile body comes over, and so on.

The novelty of the method consists in the use of the luminous electric current as an explorer and not as an agent for the supply of the vapors under examination; that is to say, the vapors are first produced by an external source of heat, and are then rendered luminous by the passage of the current. The length and bore of the tube therefore control the phenomena to a certain extent.

[1] Phil. Trans., 1873, p. 254.

[1] *Proc. R. S.*, vol. xxviii. p. 159. [2] *Proc. R. S.*, vol. xxviii, p. 162. [3] *Phil. Trans.*, 1873, p. 258.

A form of apparatus which I have found to answer very well is shown in the accompanying woodcut (Fig. 2).

A is the tube or retort containing the metal experimented on in its lower extremity, and having a platinum wire sealed into it at a distance of about two inches from the lower end, the other end being drawn out and connected by a mercury joint to an ordinary Geissler tube, which is connected by another mercury joint to the Sprengel pump C.

Another form of tube which I have used is prepared by inserting two platinum poles into a piece of combustion tubing sealed at one end, and after inserting the metal to be experimented on, drawing out the glass between the platinums to a capillary tube.

I have also tried inserting the platinum pole at the end of the retort, so that the spark passes from the surface of the metal, but this arrangement did not answer at all.

Some other modifications have been tried, but the first form I have described is that which I have found to answer best, so far as the trials have yet gone.

D is the spectroscope.

E is the lens used for focussing the image of the Geissler tube on the slit.

off can be found by examining the spectrum of this capillary tube.

I now give an account of the phenomena observed when we were working with sodium, in order to show the kind of phenomena and the changes observed.

After a vacuum has been obtained the retort is heated gradually. The pump almost immediately stops clicking, and in a short time becomes nearly full of hydrogen. The spectrum of the capillary then shows the hydrogen lines intensely bright. After some time the gas comes off far less freely, and an approach to a vacuum is again obtained. Another phenomenon now begins to show itself : on passing the current a yellow glow is seen, which gradually fills the whole space between the pole in the retort and the metal ; its spectrum consists of the lines of hydrogen and the yellow line of sodium, the red and green line being both absent until the experiment has gone on for some time.

As the distillation goes on, the yellow glow increases in brilliancy, and extends to a greater distance above the pole, and the red and green lines presently make their appearance as very faint lines.

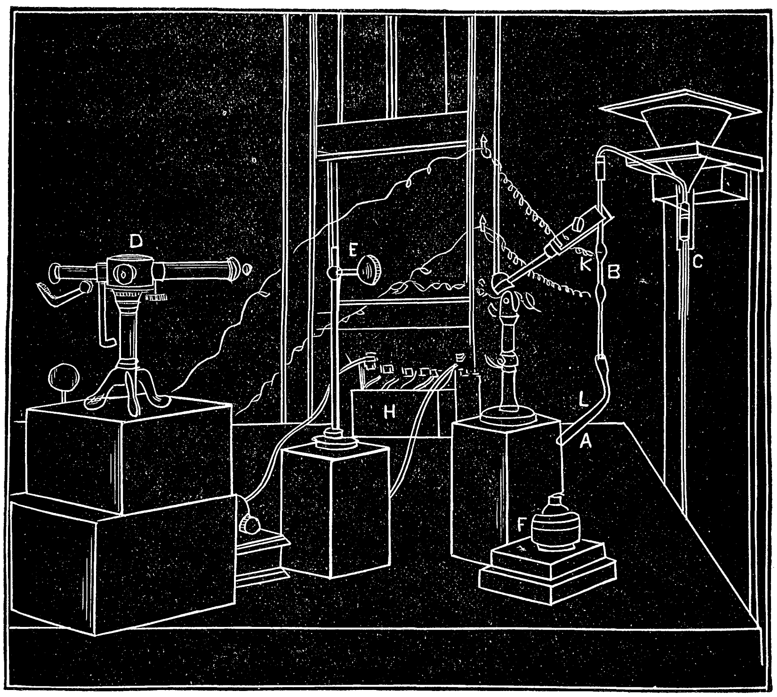

FIG. 2.—Distillation Apparatus.

F is the spirit lamp for heating the retort.

H is the battery.

K and L are the wires connected with the coil.

In the second cut (Fig. 3) the method of observing the spectrum of the vapours close to the surface of the metal is indicated ; the same letters apply, D′ being, however, in this case a direct-vision spectroscope, which was sometimes employed for convenience.

For determining the exact positions of the lines in the spectrum of the vapor in any part of the retort, a larger spectroscope, with its illuminated scale, was used in the place of the direct-vision spectroscope.

The secondary wires of the coil were connected, one with the pole in the upper bulb at B, and the other with the platinum at A.

B is an ordinary Geissler tube with two bulbs separated by a capillary tube. The great advantage of this arrangement is that this capillary portion can be used for ascertaining what gases or vapors are carried over by the pump without any interference with the retort, both wires being connected with the Geissler tube. If, for example, we are working with sodium which contains an impurity of hydrocarbon, the moment at which it begins or ceases to come

The upper boundary of the yellow is quite sharp, the lines and fluted spectrum of hydrogen appearing above it.

After the yellow glow-giving vapor (which does not attack the glass) has been visible for some time, the pump is stopped and the metal *heated more strongly*. On passing the current a little while afterwards, a very brilliant leaf-green vapor is seen underlying the yellow one, and connected with it by a sap-green vapor. The spectra then visible in the tube at the same time are—

Leaf-green ...	Green and red lines of sodium and C of hydrogen ; D absent.
Sap-green ...	Green, red, and yellow sodium lines of equal brilliancy and C of hydrogen.
Yellow	D alone and C.
Bluish-green	C and F and hydrogen structure.

To observe the green sodium line alone it is necessary to point the direct-vision spectroscope just above the surface of the metal where the green is strongest. It is also necessary to guard against internal reflections from the glass, as this may sometimes cause the D line to be seen by reflection from the surface.

This method of inquiry has been tried also with potassium, calcium, and some other metals, and with metallic salts.

With potassium and calcium we get the same inversion of phenomena, the yellow-green lines of potassium being seen without the red; while in the case of calcium the blue line alone was seen.

The fact that in these experiments we get, as before mentioned, vapors which at one and the same time exhibit different colors and different spectra at different levels in the tube, at once suggests the phenomena of fractional distillation.

It is also suggested, as a result of the application of this new method, that in the case of a considerable number of chemical substances not only the line spectrum is compound in its origin, as I suggested many years ago, but that a large number of the lines is due to molecular groupings of considerable complexity, which can be kept out of reaction by careful low temperature distillation.

So much then for one method. Now for the other.

In this I have attempted to gain new evidence in the required direction by adopting a method of work with a spark and a Bunsen flame, which Col. Donnelly suggested I should use with a spark and an electric arc. This consists in volatilizing those substances which give us flame spectra in a Bunsen flame and passing a strong spark through the flame, first during the process of volatilization, and then after the temperature of the flame has produced all the simplification it is capable of producing.

The results have been very striking; the puzzles which a comparison of flame spectra and the Fraunhofer lines has presented us find, I think, a solution; while the genesis of spectrais made much more clear.[1]

To take an instance, the flame spectrum of sodium gives us, as its brighest, a yellow line, which is also of marked importance in the solar spectrum. The flame spectra of lithium and potassium give us, as their brightest, lines in the red which have not any representatives among the Fraunhofer lines, although other lines seen with higher temperatures are present.

Whence arises this marked difference of behavior? From the similarity of the flame spectrum to that of the sun in one case, and from the dissimilarity in the other, we may imagine that in the former case—that of sodium—we are dealing with a body easily broken up, while lithium and potassium are more resistant; in other words, in the case of sodium, and dealing only with lines recognized generally as sodium lines, the flame has done the work of dissociation as completely as the sun itself. Now it is easy to

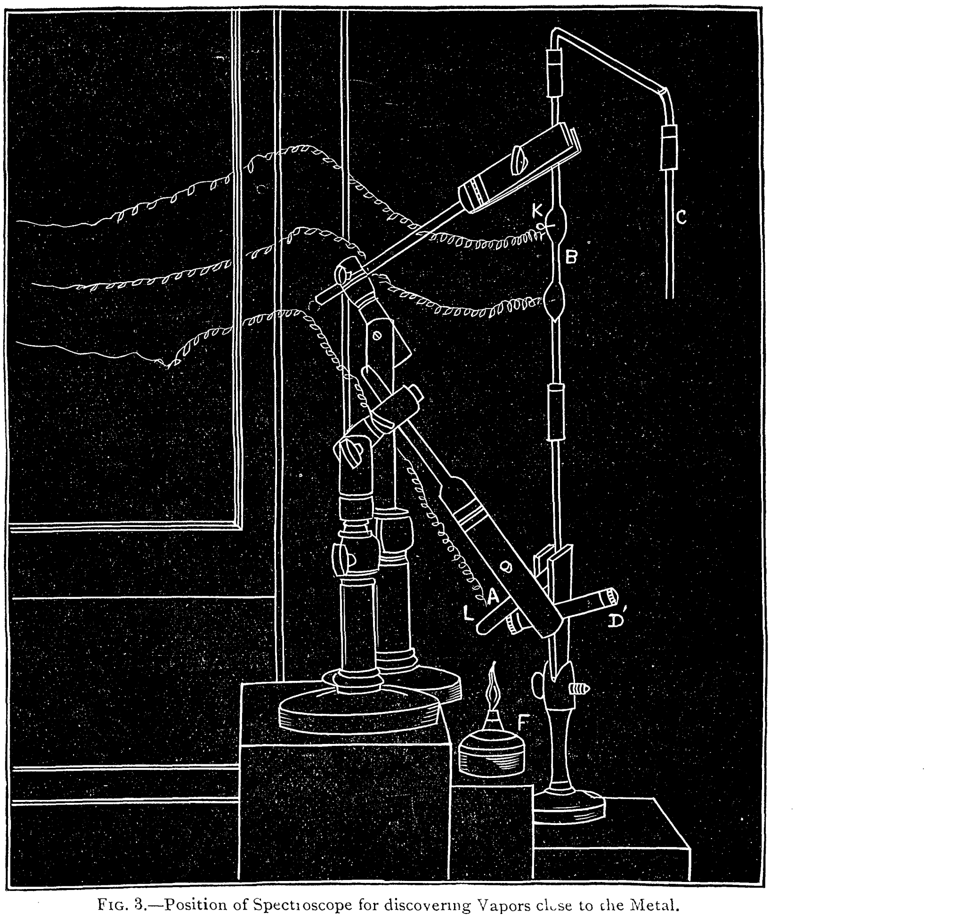

FIG. 3.—Position of Spectroscope for discovering Vapors close to the Metal.

test this point by the method now under consideration, for if this be so then (1) the chief lines and flutings of sodium should be seen in the flame itself, and (2) the spark should pass through the vapor after complete volatilization has been effected without any visible effect.

Observation and experiment have largely confirmed these predictions. Using two prisms of 60° and a high-power eyepiece to enfeeble the continuous spectrum *of the densest vapor produced at a high temperature*, the green lines, the flutings recorded by Roscoe and Schuster, and another coarser system of flutings, so far as I know not yet described, are beautirully seen. I say largely, and not completely, because the double red line and the lines in the blue have not yet been seen in the flame, either with one, two, or four prisms of 60°, though the lines are seen *during volatilization* if a spark be passed through the flame. Subsequent inquiry may perhaps show that this is due to the sharp boundary of the heated region, and to the fact that lines in question represent the vibrations of molecular

[1] I allude more especially to the production of triplets, their change into quartets, and in all probability into flutings, and to the vanishing of flutings into lines, by increasing the rate of dissociation.

groupings more complex than those which give us the yellow and green lines. The visibility of the green lines, *which are short*, in the flame, taken in connection with the fact that they have been seen alone in a vacuum tube, is enough for my present purpose.

With regard to the second point, the passage from the heat-level of the flame to that of the spark after volatilization is complete, produces no visible effect, indicating that in all probability the effects heretofore ascribed to *quantity* have been due to the presence of the molecular groupings of greater complexity. *The more there is to dissociate, the more time is required to run through the series, and the better the first stages are seen.—Nature.* J. NORMAN LOCKYER.

THE RICHMOND DIATOMACEOUS EARTH.

The stratum of fossiliferous earth underlying the cities of Richmond and Petersburg, in Virginia, when first discovered by Prof. Wm. B. Rogers, in 1842, was supposed to be peculiar to those localities; the further investigations of geologists have shown it to be a material constituent in various parts of the great Tertiary formation which bounds the continents of North and South America, and, perhaps, those of the Eastern Hemisphere also. To Mr. Charles Stodder we are indebted for the interesting and suggestive fact, that a stratum of infusorial earth, apparently the same as the Richmond deposit, has been struck at a depth of five hundred feet at Fortress Monroe, in boring an Artesian well.

The deposit at Richmond has long been famous with microgeologists for the great variety of beautiful forms it contains; the illustrious Ehrenberg having assigned to it one hundred and twelve species—nearly double the number to be found at any other place on the Atlantic coast; and the subsequent researches of microscopists have shown it to be perhaps the richest deposit of the kind in the world, every new preparation of the earth revealing some forms not before noticed, many of the most interesting remaining unnamed or described to the present day. The stratum varies in thickness from twenty to forty feet, and Major Bolton, engineer of the Church Hill tunnel, at Richmond (which runs through the deposit for three-fourths of a mile), informed me that at certain points of that excavation it reached a maximum thickness of eighty feet. In addition to an inexhaustible supply of the Diatomaceous earth, that work brought to light thousands of fossil remains of the gigantic marine monsters that, long ages ago, swam in the deep ocean over the spot where the city now stands.

An observation of the sections made by the various water courses which cut through the plateau on which Richmond is built, shows the deposit to be nearly level—its upper surface about fifteen or twenty feet below the top of the ground, and perhaps one hundred feet above tide-water. The Petersburg deposit was regarded by Prof. Tuomey as belonging to a different geologic era from that at Richmond, as evinced by the fact of his finding the casts of Pectens and other Meiocene fossils below that deposit, while at Richmond they are found above. The great difference in the character of the two deposits would also indicate this, the Petersburg Diatoms being generally much more transparent than the Richmond forms, and differing also materially in species. Upon exposure for some time to the weather, this earth assumes an almost snowy whiteness, and crumbles to a fine powder, but as first dug from the depths of the earth it resembles bituminous coal in color and solidity—so tough and hard is it, that in removing it from the tunnel it was blasted with gunpowder just as any other rock. Its composition, as nearly as can be estimated in a general way, is—10 per cent. unbroken forms of the Diatomacæ, 25 per cent. fine white sand, and the balance fine clay, formed, perhaps, mostly of the decomposed and broken Diatoms, the whole mass interspersed with many sponge spicules and a few Polycistena, and so strongly impregnated with alum that many of the wells and springs in Richmond are injured by it. To the microscopist this deposit is a source of unfailing interest, whilst the most inexperienced in such matters, upon being shown the wonderful forms found in it, are struck with surprise and delight. Had the pre-historic man possessed a microscope it might have been supposed that the forms seen in this deposit may have suggested the forms of many of his appliances, as in it may be found models of almost all the implements used by savages, whether for war, the chase, or in domestic life; witness, for instance, his stone hatchets, arrow and spear heads, knotted clubs, boomerangs, &c.; a catalogue of such matters used by civilized people would embrace plates, dishes, cups, saucers, knives, forks, scissors, balls, tops, spectacles, watches, anchors, dumb-bells, cannon, coin, musical notes and many other articles; the investigator being constantly startled by the strange resemblance which hundreds of these ancient natural forms bear to things in every day use. Certain varieties, however, predominate, and their distribution varies with level and locality, the upper portion of the stratum being comparatively poor in forms, while they increase in number and variety as we descend to the lower levels. The genus Coscinodiscus seems to characterize this earth, and of it there are dozens of varieties varying from the (microscopically) enormous C. gigas to the minute and elegant C. stelliges which resembles closely a finely polished opal, requiring a lens of wide aperture and considerable power to show its areolations. Orthosira marina is everywhere abundant, whilst many beautiful forms of Navicula are found in every gathering. Amongst these we may specially note two kinds of Pleurosigma, one of which, P. angulatum, is a favorite test Diatom, and the other, which it is is proposed to call P. Virginica, (as it is the most common form of Pleurosigma in the Virginia earths), is remarkable for the beauty of its contour, which exactly copies a willow leaf, and the want of uniformity in its striæ, which are much coarser in the middle than at the ends of the valves. It can be easily resolved with a good ¼ in. Objective, without the aid of oblique light. The genus Triceratium, is also well represented by many beautiful varieties, the handsomest of which is, perhaps, T. Maylandica, which can be resolved with almost the same ease as P. Virginica, Isthmia enervis, Biddulphia Tuomeyii, Terpsinæ musica, Anlacodiscus crux, Navicula lyra, Gonphonema, Heliopelta, Asterolampra Concinna, Asteromphalus, Brookeii, and Synedra, are more rarely met with.

From the great variety in the markings on these valves, a slide of the earth, properly prepared, becomes one of the best and most interesting tests for the performance of objectives, from the lowest to the highest powers in general use. On some of them, for instance, the areolations may be seen with a simple triplet, whilst on others a first-class objective of wide angular aperture, aided by all the modern refinements of illumination, is needed to show them.

Mr. C. L. Peticolas, of 635 Eighth street, Richmond, Va., has sent us for inspection a few of his recently mounted slides of the Richmond earth, prepared by a new process for separating the Diatoms from the extraneous matter. We have pleasure in stating that these slides show the leading characteristics of this deposit very clearly and beautifully. To those who are studying these forms of fossil diatomaceæ, the slides of Mr. Peticolas will be very acceptable, and they should be added to the cabinet of all who possess a good microscope.

A USEFUL list of the Longicorn beetles, or wood borers, constituting the vast number of insects injurious to our forest, shade, and fruit trees, may be found in the October number of *The American Entomologist*, briefly arranged in the order of their most recent classification.

THERE are two beetles in the United States, both commonly called "*Fire-flies*," which are now known to be luminous in their larval as well as in their perfect state; the one *Photurus Pensylvanica*, De Geer, the other species *Photurus pyralis*, Linn. Both the males and females of these species have wings, and therein they differ from the true Glow Worm of England (*Lampyris noctiluca*), the female of which is wingless and emits a much more brilliant light than does her winged mate.—C. V. Riley.

groupings more complex than those which give us the yellow and green lines. The visibility of the green lines, *which are short*, in the flame, taken in connection with the fact that they have been seen alone in a vacuum tube, is enough for my present purpose.

With regard to the second point, the passage from the heat-level of the flame to that of the spark after volatilization is complete, produces no visible effect, indicating that in all probability the effects heretofore ascribed to *quantity* have been due to the presence of the molecular groupings of greater complexity. *The more there is to dissociate, the more time is required to run through the series, and the better the first stages are seen.—Nature.* J. NORMAN LOCKYER.

THE RICHMOND DIATOMACEOUS EARTH.

The stratum of fossiliferous earth underlying the cities of Richmond and Petersburg, in Virginia, when first discovered by Prof. Wm. B. Rogers, in 1842, was supposed to be peculiar to those localities ; the further investigations of geologists have shown it to be a material constituent in various parts of the great Tertiary formation which bounds the continents of North and South America, and, perhaps, those of the Eastern Hemisphere also. To Mr. Charles Stodder we are indebted for the interesting and suggestive fact, that a stratum of infusorial earth, apparently the same as the Richmond deposit, has been struck at a depth of five hundred feet at Fortress Monroe, in boring an Artesian well.

The deposit at Richmond has long been famous with microgeologists for the great variety of beautiful forms it contains ; the illustrious Ehrenberg having assigned to it one hundred and twelve species—nearly double the number to be found at any other place on the Atlantic coast ; and the subsequent researches of microscopists have shown it to be perhaps the richest deposit of the kind in the world, every new preparation of the earth revealing some forms not before noticed, many of the most interesting remaining unnamed or described to the present day. The stratum varies in thickness from twenty to forty feet, and Major Bolton, engineer of the Church Hill tunnel, at Richmond (which runs through the deposit for three-fourths of a mile), informed me that at certain points of that excavation it reached a maximum thickness of eighty feet. In addition to an inexhaustible supply of the Diatomaceous earth, that work brought to light thousands of fossil remains of the gigantic marine monsters that, long ages ago, swam in the deep ocean over the spot where the city now stands.

An observation of the sections made by the various water courses which cut through the plateau on which Richmond is built, shows the deposit to be nearly level—its upper surface about fifteen or twenty feet below the top of the ground, and perhaps one hundred feet above tide-water. The Petersburg deposit was regarded by Prof. Tuomey as belonging to a different geologic era from that at Richmond, as evinced by the fact of his finding the casts of Pectens and other Meiocene fossils below that deposit, while at Richmond they are found above. The great difference in the character of the two deposits would also indicate this, the Petersburg Diatoms being generally much more transparent than the Richmond forms, and differing also materially in species. Upon exposure for some time to the weather, this earth assumes an almost snowy whiteness, and crumbles to a fine powder, but as first dug from the depths of the earth it resembles bituminous coal in color and solidity—so tough and hard is it, that in removing it from the tunnel it was blasted with gunpowder just as any other rock. Its composition, as nearly as can be estimated in a general way, is—10 per cent. unbroken forms of the Diatomacæ, 25 per cent. fine white sand, and the balance fine clay, formed, perhaps, mostly of the decomposed and broken Diatoms, the whole mass interspersed with many sponge spicules and a few Polycistena, and so strongly impregnated with alum that many of the wells and springs in Richmond are injured by it. To the microscopist this deposit is a source of unfailing interest, whilst the most inexperienced in such matters, upon being shown the wonderful forms found in it, are struck with surprise and delight. Had the pre-historic man possessed a microscope it might have been supposed that the forms seen in this deposit may have suggested the forms of many of his appliances, as in it may be found models of almost all the implements used by savages, whether for war, the chase, or in domestic life ; witness, for instance, his stone hatchets, arrow and spear heads, knotted clubs, boomerangs, &c. ; a catalogue of such matters used by civilized people would embrace plates, dishes, cups, saucers, knives, forks, scissors, balls, tops, spectacles, watches, anchors, dumb-bells, cannon, coin, musical notes and many other articles ; the investigator being constantly startled by the strange resemblance which hundreds of these ancient natural forms bear to things in every day use. Certain varieties, however, predominate, and their distribution varies with level and locality, the upper portion of the stratum being comparatively poor in forms, while they increase in number and variety as we descend to the lower levels. The genus Coscinodiscus seems to characterize this earth, and of it there are dozens of varieties varying from the (microscopically) enormous C. gigas to the minute and elegant C. stelliges which resembles closely a finely polished opal, requiring a lens of wide aperture and considerable power to show its areolations. Orthosira marina is everywhere abundant, whilst many beautiful forms of Navicula are found in every gathering. Amongst these we may specially note two kinds of Pleurosigma, one of which, P. angulatum, is a favorite test Diatom, and the other, which it is is proposed to call P. Virginica, (as it is the most common form of Pleurosigma in the Virginia earths), is remarkable for the beauty of its contour, which exactly copies a willow leaf, and the want of uniformity in its striæ, which are much coarser in the middle than at the ends of the valves, It can be easily resolved with a good ¼ in. Objective, without the aid of oblique light. The genus Triceratium, is also well represented by many beautiful varieties, the handsomest of which is, perhaps, T. Maylandica, which can be resolved with almost the same ease as P. Virginica, Isthmia enervis, Biddulphia Tuomeyii, Terpsinæ musica, Aulacodiscus crux, Navicula lyra, Gonphonema, Heliopelta, Asterolampra Concinna, Asteromphalus, Brookeii, and Synedra, are more rarely met with.

From the great variety in the markings on these valves, a slide of the earth, properly prepared, becomes one of the best and most interesting tests for the performance of objectives, from the lowest to the highest powers in general use. On some of them, for instance, the areolations may be seen with a simple triplet, whilst on others a first-class objective of wide angular aperture, aided by all the modern refinements of illumination, is needed to show them.

Mr. C. L. Peticolas, of 635 Eighth street, Richmond, Va., has sent us for inspection a few of his recently mounted slides of the Richmond earth, prepared by a new process for separating the Diatoms from the extraneous matter. We have pleasure in stating that these slides show the leading characteristics of this deposit very clearly and beautifully. To those who are studying these forms of fossil diatomaceæ, the slides of Mr. Peticolas will be very acceptable, and they should be added to the cabinet of all who possess a good microscope.

A USEFUL list of the Longicorn beetles, or wood borers, constituting the vast number of insects injurious to our forest, shade, and fruit trees, may be found in the October number of *The American Entomologist*, briefly arranged in the order of their most recent classification.

THERE are two beetles in the United States, both commonly called "*Fire-flies*," which are now known to be luminous in their larval as well as in their perfect state; the one *Photurus Pensylvanica*, De Geer, the other species *Photurus pyralis*, Linn. Both the males and females of these species have wings, and therein they differ from the true Glow Worm of England (*Lampyris noctiluca*), the female of which is wingless and emits a much more brilliant light than does her winged mate.—C. V. Riley.

AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK.

The customary autumn reception at the American Museum of Natural History, Seventy-seventh street, near Central Park, took place on the 27th instant, from two to five o'clock in the afternoon. The attendance was not so large as upon former occasions. Among the trustees present were noted Mr. Robert L. Stuart, President; Messrs. Robert Colgate, Benjamin H. Field, Adrian Iselin, Morris K. Jesup, James M. Constable, Joseph W. Drexel, Frederic W. Stevens, Hugh Auchincloss, Oliver Harriman, ex-Governor E. D. Morgan, John H. Sherwood, R. H. Keene, Professor Eggleston, Rev. Dr. Trimble, Arkansas; Professor Daniel S. Martin, Rutger's College, with many others.

The additions and improvements since the last reception, in May of the present year, may be briefly summarized as follows: In the lower hall the Binney and Bland collection of land and fresh water shells formed a new feature. It contained the typical specimens that are to be met with in the works of those authors, and was presented by twelve members. The whole was enclosed in a desk case, placed between cases R and K. Besides this the skeletons of three Australians were there to challenge the attention of scientists. These interesting specimens were the gift of Mr. Morris K. Jesup, and may be inspected in case A. In the main hall, the Maximilian collection of birds, attracted the attention of visitors; they have been re-mounted on the new stands described in an article in "SCIENCE," October 7 last, under the title of "Bird Furniture, by Dr. Holder, the Assistant Superintendent. We direct the attention of those making collections of Natural History specimens, to these stands; they are inexpensive, and possess many advantages. The North American collection was increased by six hundred specimens.

The gallery stairway showed a detailed ethnological map of Africa, drawn on a large scale by Professor Bickmore. The additions to the Ethnological Collection from the South Seas consist of a war canoe (case No. 1), New Zealand weapons and carvings (case No. 3) and stone axes from New Guinea (case No. 4). The set of ornaments and carvings from British Columbia, presented by Mr. H. R. Bishop (case M), proved to be interesting, as many items were included which appeared unfamiliar to most people present. The Geological Hall received seven geological maps of Eastern North America, some Encrinites and other fossils from various formations. Cases A, B, C, D and E were re-arranged and labelled. In the desk cases specimens were placed which served to illustrate Dana's "Manual of Geology." The rearrangement and labelling of the portions alluded to are a considerable improvement.

Altogether the several collections and their belongings presented the appearance of being well kept and arranged accrding to the best scientific principles. The trustees say that the elevated railroad has brought a greatly increased number of visitors to the Museum, and they hope to make it still more attractive as a place of instructive amusement. It has been suggested that such advanced classes of the higher schools and colleges as are making a regular study of natural history could find in this collection an excellent opportunity for advancing themselves in their chosen branch of education. If professors or teachers would accompany their pupils periodically through the Museum, giving progressive lectures on the different subjects presented for consideration, it is believed that the results would, under all aspects, be most beneficial.

ASTRONOMICAL NOTES.

Dr. W. L. Elkin has made a re-discussion of the various series of observations of α Centauri for the determination of the value of its parallax. These include the observations of Henderson, Maclear, Moesta and E. J. Stone. Besides a recomputation of the absolute parallax, Dr. Elkin has selected the observations which were made on nights when both α and β Centauri were observed, and from these determined their relative parallax. The discussion includes a new determination of the orbit of α considered as a double star, as well as a discussion of the relative proper motions of α and β. From a careful examination of each series he concludes that Maclaer's is the only one worthy of confidence. He finds that, although the probable error of Moesta's series is small, the annual variation may be accounted for as the effect of changes in temperature. Maclear's observations give for the relative parallax of α and β: $0''.50 + 0''.08$.

Dr. Henry Draper has succeeded in photographing the bright part of the nebula in Orion in the vicinity of the trapezium. The photographs show the mottled appearance of this region distinctly. They were taken by the aid of a triple objective of eleven inches aperture made by Alvan Clark and Sons, and corrected especially for the photographic rays. The exposure was for fifty minutes. A detailed description of the negatives has not yet been published, but will be soon. O. S.

SWIFTS' COMET.

By ED. E. BARNARD.

The large comet discovered by Prof. Lewis Swift on the night of Octer 10th in R. A. 21 h. 30 m. north declination $17^{\circ} 30'$, is now in excellent position for observation. On October 21st it followed the fourth magnitude—star κ *Pegasi* by somewhat less than 1°. At 8 h. Washington *m. t.*, I determined its position by the aid of a ring micrometer, R. A. 21 h. 42¼ m. Dec. $+ 25^{\circ} 1'$. The following night, October 22d, its position was at 10 h. 20 m. R. A. 21 h. 44 m. 3 sec. Dec. $+ 26^{\circ} 2'$. It is moving moderately fast in a northeasterly direction. It was observed again on the nights of October 23d and 24th. The comet is perfectly transparent. At each observation it passed over a number of small stars, 8 or 9 mag., these were seen through its very centre; they were slightly dimmed by the material of the comet.

It appears large and diffused with a slight condensation at the middle or the preceding side, with probably faint evidences of a diffused tail.

It can be seen with a very small telescope, being plainly visible on the 24th in my 1⅛ in. finder.

NASHVILLE, TENN., *October* 25.

BOTANY.

The first annual Report upon Useful and Noxious Plants, presented by Professor T. J. Burrill to the Illinois State Board of Agriculture, contains a paper suggesting the more general cultivation of the Catalpas (*Catalpa bignonioides.*) Professor Burrill states: "I write 'these trees' advisedly, believing that the two kinds now known as the common and the hardy, or the eastern or southern and the western, are really different species. The wonder is that botanists had not long ago detected this difference and that in our manuals of botany the two had not been given under specific names.

At Urbana, Ill., in 1880, the one came into flower the first week in June; the other was nearly three weeks later, being in full flower about June 24th. They differ in other respects quite as much as well recognized species of oak, ash and cotton-wood; much more than described species of willow. But *Catalpa bignonioides*, Walt., is the only name to be found in the ordinary books, devoted to the flora, in whole or part, of North America. In 1853 Dr. Warder, of Ohio, noticing the showy flowers of some trees at Dayton, Ohio, and supposing these to be a *variety* of the well known species with this peculiarity, named the variety *speciosa*. It now appears that this large flowered kind is the common indigenous form found in the States of Indiana, Illinois, Kentucky, Tennessee, Wisconsin, Arkansas, etc., and botanists will doubtless henceforth write *Catalpa speciosa*, Warder, as a distinct species. Contrasted with *Catalpa bignonioides* the flowers are earlier and larger; the seed pods are larger; the bark is darker, and does not scale off, giving quite a different aspect to the trunk of a mature specimen; the growth is more erect, causing a better bole and finer head, and the tree is not so liable to be killed by the severities of winter. Added to all this the trees are so characteristically different that anyone can readily distinguish them. In *C. bignonioides* they are narrow and the fringe of the wing is close and pointed; in *C. speciosa* the larger seed has a wider wing, terminated at each end with a broad fringe of softer hairs. Unfortunately most of the cultivated Catalpa trees in Illinois have been of the tender species, and, although the wonderful durability

AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK.

The customary autumn reception at the American Museum of Natural History, Seventy-seventh street, near Central Park, took place on the 27th instant, from two to five o'clock in the afternoon. The attendance was not so large as upon former occasions. Among the trustees present were noted Mr. Robert L. Stuart, President; Messrs. Robert Colgate, Benjamin H. Field, Adrian Iselin, Morris K. Jesup, James M. Constable, Joseph W. Drexel, Frederic W. Stevens, Hugh Auchincloss, Oliver Harriman, ex-Governor E. D. Morgan, John H. Sherwood, R. H. Keene, Professor Eggleston, Rev. Dr. Trimble, Arkansas; Professor Daniel S. Martin, Rutger's College, with many others.

The additions and improvements since the last reception, in May of the present year, may be briefly summarized as follows: In the lower hall the Binney and Bland collection of land and fresh water shells formed a new feature. It contained the typical specimens that are to be met with in the works of those authors, and was presented by twelve members. The whole was enclosed in a desk case, placed between cases R and K. Besides this the skeletons of three Australians were there to challenge the attention of scientists. These interesting specimens were the gift of Mr. Morris K. Jesup, and may be inspected in case A. In the main hall, the Maximilian collection of birds, attracted the attention of visitors; they have been re-mounted on the new stands described in an article in "SCIENCE," October 7 last, under the title of "Bird Furniture, by Dr. Holder, the Assistant Superintendent. We direct the attention of those making collections of Natural History specimens, to these stands; they are inexpensive, and possess many advantages. The North American collection was increased by six hundred specimens.

The gallery stairway showed a detailed ethnological map of Africa, drawn on a large scale by Professor Bickmore. The additions to the Ethnological Collection from the South Seas consist of a war canoe (case No. 1), New Zealand weapons and carvings (case No. 3) and stone axes from New Guinea (case No. 4). The set of ornaments and carvings from British Columbia, presented by Mr. H. R. Bishop (case M), proved to be interesting, as many items were included which appeared unfamiliar to most people present. The Geological Hall received seven geological maps of Eastern North America, some Encrinites and other fossils from various formations. Cases A, B, C, D and E were re-arranged and labelled. In the desk cases specimens were placed which served to illustrate Dana's "Manual of Geology." The rearrangement and labelling of the portions alluded to are a considerable improvement.

Altogether the several collections and their belongings presented the appearance of being well kept and arranged accrding to the best scientific principles. The trustees say that the elevated railroad has brought a greatly increased number of visitors to the Museum, and they hope to make it still more attractive as a place of instructive amusement. It has been suggested that such advanced classes of the higher schools and colleges as are making a regular study of natural history could find in this collection an excellent opportunity for advancing themselves in their chosen branch of education. If professors or teachers would accompany their pupils periodically through the Museum, giving progressive lectures on the different subjects presented for consideration, it is believed that the results would, under all aspects, be most beneficial.

ASTRONOMICAL NOTES.

Dr. W. L. Elkin has made a re-discussion of the various series of observations of α Centauri for the determination of the value of its parallax. These include the observations of Henderson, Maclear, Moesta and E. J. Stone. Besides a recomputation of the absolute parallax, Dr. Elkin has selected the observations which were made on nights when both α and β Centauri were observed, and from these determined their relative parallax. The discussion includes a new determination of the orbit of α considered as a double star, as well as a discussion of the relative proper motions of α and β. From a careful examination of each series he concludes that Maclaer's is the only one worthy of confidence. He finds that, although the probable error of Moesta's series is small, the annual variation may be accounted for as the effect of changes in temperature. Maclear's observations give for the relative parallax of α and β: $0''.50 + 0''.08$.

Dr. Henry Draper has succeeded in photographing the bright part of the nebula in Orion in the vicinity of the trapezium. The photographs show the mottled appearance of this region distinctly. They were taken by the aid of a triple objective of eleven inches aperture made by Alvan Clark and Sons, and corrected especially for the photographic rays. The exposure was for fifty minutes. A detailed description of the negatives has not yet been published, but will be soon.

O. S.

SWIFTS' COMET.

By ED. E. BARNARD.

The large comet discovered by Prof. Lewis Swift on the night of Octer 10th in R. A. 21 h. 30 m. north declination 17° 30', is now in excellent position for observation. On October 21st it followed the fourth magnitude—star κ *Pegasi* by somewhat less than 1°. At 8 h. Washington *m. t.*, I determined its position by the aid of a ring micrometer, R. A. 21 h. 42¼ m. Dec. + 25° 1'. The following night, October 22d, its position was at 10 h. 20 m. R. A. 21 h. 44 m. 3 sec. Dec. + 26° 2'. It is moving moderately fast in a north. easterly direction. It was observed again on the nights of October 23d and 24th. The comet is perfectly transparent. At each observation it passed over a number of small stars, 8 or 9 mag., these were seen through its very centre; they were slightly dimmed by the material of the comet.

It appears large and diffused with a slight condensation at the middle or the preceding side, with probably faint evidences of a diffused tail.

It can be seen with a very small telescope, being plainly visible on the 24th in my 1⅛ in. finder.

NASHVILLE, TENN., *October* 25.

BOTANY.

The first annual Report upon Useful and Noxious Plants, presented by Professor T. J. Burrill to the Illinois State Board of Agriculture, contains a paper suggesting the more general cultivation of the Catalpas (*Catalpa bignonioides*.) Professor Burrill states: "I write 'these trees' advisedly, believing that the two kinds now known as the common and the hardy, or the eastern or southern and the western, are really different species. The wonder is that botanists had not long ago detected this difference and that in our manuals of botany the two had not been given under specific names.

At Urbana, Ill., in 1880, the one came into flower the first week in June; the other was nearly three weeks later, being in full flower about June 24th. They differ in other respects quite as much as well recognized species of oak, ash and cotton-wood; much more than described species of willow. But *Catalpa bignonioides*, Walt., is the only name to be found in the ordinary books, devoted to the flora, in whole or part, of North America. In 1853 Dr. Warder, of Ohio, noticing the showy flowers of some trees at Dayton, Ohio, and supposing these to be a *variety* of the well known species with this peculiarity, named the variety *speciosa*. It now appears that this large flowered kind is the common indigenous form found in the States of Indiana, Illinois, Kentucky, Tennessee, Wisconsin, Arkansas, etc., and botanists will doubtless henceforth write *Catalpa speciosa*, Warder, as a distinct species. Contrasted with *Catalpa bignonioides* the flowers are earlier and larger; the seed pods are larger; the bark is darker, and does not scale off, giving quite a different aspect to the trunk of a mature specimen; the growth is more erect, causing a better bole and finer head, and the tree is not so liable to be killed by the severities of winter. Added to all this the trees are so characteristically different that anyone can readily distinguish them. In *C. bignonioides* they are narrow and the fringe of the wing is close and pointed; in *C. speciosa* the larger seed has a wider wing, terminated at each end with a broad fringe of softer hairs. Unfortunately most of the cultivated Catalpa trees in Illinois have been of the tender species, and, although the wonderful durability

AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK.

The customary autumn reception at the American Museum of Natural History, Seventy-seventh street, near Central Park, took place on the 27th instant, from two to five o'clock in the afternoon. The attendance was not so large as upon former occasions. Among the trustees present were noted Mr. Robert L. Stuart, President; Messrs. Robert Colgate, Benjamin H. Field, Adrian Iselin, Morris K. Jesup, James M. Constable, Joseph W. Drexel, Frederic W. Stevens, Hugh Auchincloss, Oliver Harriman, ex-Governor E. D. Morgan, John H. Sherwood, R. H. Keene, Professor Eggleston, Rev. Dr. Trimble, Arkansas; Professor Daniel S. Martin, Rutger's College, with many others.

The additions and improvements since the last reception, in May of the present year, may be briefly summarized as follows: In the lower hall the Binney and Bland collection of land and fresh water shells formed a new feature. It contained the typical specimens that are to be met with in the works of those authors, and was presented by twelve members. The whole was enclosed in a desk case, placed between cases R and K. Besides this the skeletons of three Australians were there to challenge the attention of scientists. These interesting specimens were the gift of Mr. Morris K. Jesup, and may be inspected in case A. In the main hall, the Maximilian collection of birds, attracted the attention of visitors; they have been re-mounted on the new stands described in an article in "SCIENCE," October 7 last, under the title of "Bird Furniture, by Dr. Holder, the Assistant Superintendent. We direct the attention of those making collections of Natural History specimens, to these stands; they are inexpensive, and possess many advantages. The North American collection was increased by six hundred specimens.

The gallery stairway showed a detailed ethnological map of Africa, drawn on a large scale by Professor Bickmore. The additions to the Ethnological Collection from the South Seas consist of a war canoe (case No. 1), New Zealand weapons and carvings (case No. 3) and stone axes from New Guinea (case No. 4). The set of ornaments and carvings from British Columbia, presented by Mr. H. R. Bishop (case M), proved to be interesting, as many items were included which appeared unfamiliar to most people present. The Geological Hall received seven geological maps of Eastern North America, some Encrinites and other fossils from various formations. Cases A, B, C, D and E were re-arranged and labelled. In the desk cases specimens were placed which served to illustrate Dana's "Manual of Geology." The rearrangement and labelling of the portions alluded to are a considerable improvement.

Altogether the several collections and their belongings presented the appearance of being well kept and arranged accrding to the best scientific principles. The trustees say that the elevated railroad has brought a greatly increased number of visitors to the Museum, and they hope to make it still more attractive as a place of instructive amusement. It has been suggested that such advanced classes of the higher schools and colleges as are making a regular study of natural history could find in this collection an excellent opportunity for advancing themselves in their chosen branch of education. If professors or teachers would accompany their pupils periodically through the Museum, giving progressive lectures on the different subjects presented for consideration, it is believed that the results would, under all aspects, be most beneficial.

ASTRONOMICAL NOTES.

Dr. W. L. Elkin has made a re-discussion of the various series of observations of α Centauri for the determination of the value of its parallax. These include the observations of Henderson, Maclear, Moesta and E. J. Stone. Besides a recomputation of the absolute parallax, Dr. Elkin has selected the observations which were made on nights when both α and β Centauri were observed, and from these determined their relative parallax. The discussion includes a new determination of the orbit of α considered as a double star, as well as a discussion of the relative proper motions of α and β. From a careful examination of each series he concludes that Maclaer's is the only one worthy of confidence. He finds that, although the probable error of Moesta's series is small, the annual variation may be accounted for as the effect of changes in temperature. Maclear's observations give for the relative parallax of α and β: $0''.50 + 0''.08$.

Dr. Henry Draper has succeeded in photographing the bright part of the nebula in Orion in the vicinity of the trapezium. The photographs show the mottled appearance of this region distinctly. They were taken by the aid of a triple objective of eleven inches aperture made by Alvan Clark and Sons, and corrected especially for the photographic rays. The exposure was for fifty minutes. A detailed description of the negatives has not yet been published, but will be soon.

O. S.

SWIFTS' COMET.

By ED. E. BARNARD.

The large comet discovered by Prof. Lewis Swift on the night of Octer 10th in R. A. 21 h. 30 m. north declination 17° 30′, is now in excellent position for observation. On October 21st it followed the fourth magnitude—star κ *Pegasi* by somewhat less than 1°. At 8 h. Washington *m. t.*, I determined its position by the aid of a ring micrometer, R. A. 21 h. 42¼ m. Dec. + 25° 1′. The following night, October 22d, its position was at 10 h. 20 m. R. A. 21 h. 44 m. 3 sec- Dec. + 26° 2′. It is moving moderately fast in a north. easterly direction. It was observed again on the nights of October 23d and 24th. The comet is perfectly transparent. At each observation it passed over a number of small stars, 8 or 9 mag., these were seen through its very centre; they were slightly dimmed by the material of the comet.

It appears large and diffused with a slight condensation at the middle or the preceding side, with probably faint evidences of a diffused tail.

It can be seen with a very small telescope, being plainly visible on the 24th in my 1⅛ in. finder.

NASHVILLE, TENN., *October* 25.

BOTANY.

The first annual Report upon Useful and Noxious Plants, presented by Professor T. J. Burrill to the Illinois State Board of Agriculture, contains a paper suggesting the more general cultivation of the Catalpas (*Catalpa bignonioides.*) Professor Burrill states: "I write 'these trees' advisedly, believing that the two kinds now known as the common and the hardy, or the eastern or southern and the western, are really different species. The wonder is that botanists had not long ago detected this difference and that in our manuals of botany the two had not been given under specific names.

At Urbana, Ill., in 1880, the one came into flower the first week in June; the other was nearly three weeks later, being in full flower about June 24th. They differ in other respects quite as much as well recognized species of oak, ash and cotton-wood; much more than described species of willow. But *Catalpa bignonioides*, Walt., is the only name to be found in the ordinary books, devoted to the flora, in whole or part, of North America. In 1853 Dr. Warder, of Ohio, noticing the showy flowers of some trees at Dayton, Ohio, and supposing these to be a *variety* of the well known species with this peculiarity, named the variety *speciosa*. It now appears that this large flowered kind is the common indigenous form found in the States of Indiana, Illinois, Kentucky, Tennessee, Wisconsin, Arkansas, etc., and botanists will doubtless henceforth write *Catalpa speciosa*, Warder, as a distinct species. Contrasted with *Catalpa bignonioides* the flowers are earlier and larger; the seed pods are larger; the bark is darker, and does not scale off, giving quite a different aspect to the trunk of a mature specimen; the growth is more erect, causing a better bole and finer head, and the tree is not so liable to be killed by the severities of winter. Added to all this the trees are so characteristically different that anyone can readily distinguish them. In *C. bignonioides* they are narrow and the fringe of the wing is close and pointed; in *C. speciosa* the larger seed has a wider wing, terminated at each end with a broad fringe of softer hairs. Unfortunately most of the cultivated Catalpa trees in Illinois have been of the tender species, and, although the wonderful durability

AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK.

The customary autumn reception at the American Museum of Natural History, Seventy-seventh street, near Central Park, took place on the 27th instant, from two to five o'clock in the afternoon. The attendance was not so large as upon former occasions. Among the trustees present were noted Mr. Robert L. Stuart, President; Messrs. Robert Colgate, Benjamin H. Field, Adrian Iselin, Morris K. Jesup, James M. Constable, Joseph W. Drexel, Frederic W. Stevens, Hugh Auchincloss, Oliver Harriman, ex-Governor E. D. Morgan, John H. Sherwood, R. H. Keene, Professor Eggleston, Rev. Dr. Trimble, Arkansas; Professor Daniel S. Martin, Rutger's College, with many others.

The additions and improvements since the last reception, in May of the present year, may be briefly summarized as follows: In the lower hall the Binney and Bland collection of land and fresh water shells formed a new feature. It contained the typical specimens that are to be met with in the works of those authors, and was presented by twelve members. The whole was enclosed in a desk case, placed between cases R and K. Besides this the skeletons of three Australians were there to challenge the attention of scientists. These interesting specimens were the gift of Mr. Morris K. Jesup, and may be inspected in case A. In the main hall, the Maximilian collection of birds, attracted the attention of visitors; they have been re-mounted on the new stands described in an article in "SCIENCE," October 7 last, under the title of "Bird Furniture, by Dr. Holder, the Assistant Superintendent. We direct the attention of those making collections of Natural History specimens, to these stands; they are inexpensive, and possess many advantages. The North American collection was increased by six hundred specimens.

The gallery stairway showed a detailed ethnological map of Africa, drawn on a large scale by Professor Bickmore. The additions to the Ethnological Collection from the South Seas consist of a war canoe (case No. 1), New Zealand weapons and carvings (case No. 3) and stone axes from New Guinea (case No. 4). The set of ornaments and carvings from British Columbia, presented by Mr. H. R. Bishop (case M), proved to be interesting, as many items were included which appeared unfamiliar to most people present. The Geological Hall received seven geological maps of Eastern North America, some Encrinites and other fossils from various formations. Cases A, B, C, D and E were re-arranged and labelled. In the desk cases specimens were placed which served to illustrate Dana's "Manual of Geology." The rearrangement and labelling of the portions alluded to are a considerable improvement.

Altogether the several collections and their belongings presented the appearance of being well kept and arranged accrding to the best scientific principles. The trustees say that the elevated railroad has brought a greatly increased number of visitors to the Museum, and they hope to make it still more attractive as a place of instructive amusement. It has been suggested that such advanced classes of the higher schools and colleges as are making a regular study of natural history could find in this collection an excellent opportunity for advancing themselves in their chosen branch of education. If professors or teachers would accompany their pupils periodically through the Museum, giving progressive lectures on the different subjects presented for consideration, it is believed that the results would, under all aspects, be most beneficial.

ASTRONOMICAL NOTES.

Dr. W. L. Elkin has made a re-discussion of the various series of observations of α Centauri for the determination of the value of its parallax. These include the observations of Henderson, Maclear, Moesta and E. J. Stone. Besides a recomputation of the absolute parallax, Dr. Elkin has selected the observations which were made on nights when both α and β Centauri were observed, and from these determined their relative parallax. The discussion includes a new determination of the orbit of α considered as a double star, as well as a discussion of the relative proper motions of α and β. From a careful examination of each series he concludes that Maclaer's is the only one worthy of confidence. He finds that, although the probable error of Moesta's series is small, the annual variation may be accounted for as the effect of changes in temperature. Maclear's observations give for the relative parallax of α and β: $0''.50 + 0''.08$.

Dr. Henry Draper has succeeded in photographing the bright part of the nebula in Orion in the vicinity of the trapezium. The photographs show the mottled appearance of this region distinctly. They were taken by the aid of a triple objective of eleven inches aperture made by Alvan Clark and Sons, and corrected especially for the photographic rays. The exposure was for fifty minutes. A detailed description of the negatives has not yet been published, but will be soon. O. S.

SWIFTS' COMET.

By ED. E. BARNARD.

The large comet discovered by Prof. Lewis Swift on the night of Octer 10th in R. A. 21 h. 30 m. north declination 17° 30′, is now in excellent position for observation. On October 21st it followed the fourth magnitude—star κ *Pegasi* by somewhat less than 1°. At 8 h. Washington *m. t.*, I determined its position by the aid of a ring micrometer, R. A. 21 h. 42¼ m. Dec. + 25° 1′. The following night, October 22d, its position was at 10 h. 20 m. R. A. 21 h. 44 m. 3 sec. Dec. + 26° 2′. It is moving moderately fast in a north. easterly direction. It was observed again on the nights of October 23d and 24th. The comet is perfectly transparent. At each observation it passed over a number of small stars, 8 or 9 mag., these were seen through its very centre; they were slightly dimmed by the material of the comet.

It appears large and diffused with a slight condensation at the middle or the preceding side, with probably faint evidences of a diffused tail.

It can be seen with a very small telescope, being plainly visible on the 24th in my 1⅛ in. finder.

NASHVILLE, TENN., *October* 25.

BOTANY.

The first annual Report upon Useful and Noxious Plants, presented by Professor T. J. Burrill to the Illinois State Board of Agriculture, contains a paper suggesting the more general cultivation of the Catalpas (*Catalpa bignonioides.*) Professor Burrill states: "I write 'these trees' advisedly, believing that the two kinds now known as the common and the hardy, or the eastern or southern and the western, are really different species. The wonder is that botanists had not long ago detected this difference and that in our manuals of botany the two had not been given under specific names.

At Urbana, Ill., in 1880, the one came into flower the first week in June; the other was nearly three weeks later, being in full flower about June 24th. They differ in other respects quite as much as well recognized species of oak, ash and cotton-wood; much more than described species of willow. But *Catalpa bignonioides*, Walt., is the only name to be found in the ordinary books, devoted to the flora, in whole or part, of North America. In 1853 Dr. Warder, of Ohio, noticing the showy flowers of some trees at Dayton, Ohio, and supposing these to be a *variety* of the well known species with this peculiarity, named the variety *speciosa*. It now appears that this large flowered kind is the common indigenous form found in the States of Indiana, Illinois, Kentucky, Tennessee, Wisconsin, Arkansas, etc., and botanists will doubtless henceforth write *Catalpa speciosa*, Warder, as a distinct species. Contrasted with *Catalpa bignonioides* the flowers are earlier and larger; the seed pods are larger; the bark is darker, and does not scale off, giving quite a different aspect to the trunk of a mature specimen; the growth is more erect, causing a better bole and finer head, and the tree is not so liable to be killed by the severities of winter. Added to all this the trees are so characteristically different that anyone can readily distinguish them. In *C. bignonioides* they are narrow and the fringe of the wing is close and pointed; in *C. speciosa* the larger seed has a wider wing, terminated at each end with a broad fringe of softer hairs. Unfortunately most of the cultivated Catalpa trees in Illinois have been of the tender species, and, although the wonderful durability

of the wood has long been known, its liability to 'winter-kill' and its irregular, crooked growth has prevented its being planted for timber."

Much space is also given in this report to the subject of Fungi on living plants, which are more disastrous to crops than the ravages of insects. These forms include rusts, smuts, mildews, rots, blights, etc., the rust alone on wheat taking from the former more than all the tax collectors, and creating such losses as to frighten cul tivators from their business. Professor Burrill regrets that the study of Fungi receives so little attention in this country, and says the number of American botanists who have published original accounts of the development of any fungous species may be counted on the fingers of one hand. As much practical importance and scientific interest is attached to such a study, we trust many botanists may in the future give more of their time to original investigations in this direction.

MICROSCOPY.

The American Monthly Microscopical Journal for October, describes a warm stage for the Microscope, by Professor E. H. Bartley. It has the advantage of being so simple that it can be constructed at home with a few inexpensive materials. We once saw this apparatus shown by the inventor at the New York Microscopical Society, and considered it a success.

Simple forms of mechanical figures are described by Mr. J. Sullivant.

Professor C. C. Merriman's interesting paper on the microscopical collections made by him in Florida, occupies nine pages of this number.

We regret that Mr. Frederick Habirshaw's "*Catalogue of the Diatomaceæ*" will be delayed in the publication for the want of sufficient promise of patronage. This may arise from many not understanding the nature of the work or its construction. If the editor of the *American Monthly Microscopical Journal*, who has the matter in hand, would print a sample page in his journal, it might remove such a difficulty. We believe we have heard the author himself state that the book in question would be useless to those not having a full library of works on the subject, so as to avail themselves of the ample references he makes to the published literature of the subject.

The demand for such a work must be very limited; on the other hand a condensation of all this literature would be very welcome. A comprehensive work on the diatomaceæ, well illustrated, is much wanted and if issued in monthly parts, at a moderate price, would command a fair sale both at home and abroad.

Mr. Habirshaw appears to have the material for such a work in his possession, and he has given ample proof of his literary ability to undertake the task.

We think ten dollars would be better invested in a work such as we suggest, than five dollars in an index to a scattered literature, which the purchaser can never hope to possess.

PHYSICAL NOTES.

OBSERVATION MADE ON A GROUP OF RAYS IN THE SOLAR SPECTRUM.—L. Thollon figures and describes a group of four rays, situate in the Orange. Two of these rays belong to Iron, their wave-lengths being respectively 5976·1 and 5974·6. The other two are Telluric, and their wavelengths are 5976·35 and 5974·36.

CAUSE OF THE VARIATIONS OF THE FIXED POINTS OF THERMOMETERS.—J. M. Crafts cites some experiments which reduce to nothing, or almost so, the part played by pressure in the permanent elevation of the zero-point. The glass blown at the lamp and exposed for a long time to the action of heat diminishes in volume by means of some internal change, and it is not demonstrated that pressure plays any part whatever in the phenomenon. The particles of glass which have been removed asunder whilst it was being blown do not return immediately to their normal position at a lower temperature; we observe disturbances for some time, and finally the glass may remain for a long time in a state of tension at the ordinary temperature. The action of heat at a given temperature (*e.g.*, 355°), giving a greater mobility to the particles, favors their return to the normal position, and gives scope to a contraction. But the glass, when cooling from this latter temperature retains a part of the displacement peculiar to 355°. On heating again to a lower temperature (*e.g.*, 300°) a new decrease of volume is produced, so that a very slow cooling, which produces successively all these effects upon the particles of glass, must ensure the greatest stability.

RAPID ALCOHOLIC FERMENTATION.—In order to effect rapid fermentation for the destruction of the sugar contained in wines, J. Bouissngault suggests that the sample be mixed with water and yeast, and placed in connection with an exhausting syringe, reduces the pressure, and thus which eliminates the alcohol as fast as formed. The fermentation, not being checked by its presence, goes on till all the sugar is decomposed.

INCONVENIENCES, FROM A PHYSIOLOGICAL POINT OF VIEW, OF THE SUBSTITUTION OF AMYLIC ALCOHOL FOR ETHER IN STAS'S PROCESS FOR THE DETECTION OF MORPHINE.—As amylic alcohol, even in very small doses, produces in animals systoms closely resembling narcotism, and as it is not readily removed from the cadaveric extract, physiological experimentation in confirmation of the chemical reactions of morphine is rendered untrustworthy.—*Compes Rendus*.

INFLUENCE OF THE GALVANIC CURRENT ON BACTERIA F. Cohn and B. Mendelsohn carried out their experiments to verify the assertion of Schiel, that the galvanic current prevented the development of Bacteria. The results were that a feeble current from one pair of elements had no perceptible effect; a current from two elements rendered the solution inactive at the positive pole; a current from five, continued for twenty-four hours, completely sterilized the whole solution, and deprived it of its power to infect another solution. The solution at the positive pole was first affected; with the stronger current the liquid became acid at the positive and alkaline at the negative pole. The induction current had no perceptible effect on the Bacteria.—*Jour. Chem. Soc.*

EFFECT OF AGE ON THE QUALITY OF IRON.—Previous tests have shown that iron, subject to even fifty years of use and exposure, is not perceptibly changed in quality, either in strength or elasticity. Professor Thurston recently tested the remains of the Fairmount Suspension Bridge, which had been in use forty years, and found the iron in no man ner deteriorated.

PHOSPHORESCENT LIGHTING.—Dr. Phipson takes Sulphide of Barium, or some other substance which is rendered phosphorescent by the solar rays, and encloses it in a Geissler tube, through which he passes a constant electric current of a feeble but regular intensity. He claims to obtain in this manner a uniform and agreeable light, at a lower cost than that of gas.

BOOKS RECEIVED.

SUGAR ANALYSIS—A DESCRIPTION OF THE METHODS USED IN ESTIMATING THE CONSTITUENTS. By M. Benjamin, Ph. B. New York. 1880.

To those who desire a concise and practical guide to this subject, Dr. Benjamin's essay, published in pamphlet form with twenty illustrations, will perhaps be more serviceable than a more elaborate work. The essential facts for a general comprehension of the subject have been judiciously arranged.

of the wood has long been known, its liability to 'winter-kill' and its irregular, crooked growth has prevented its being planted for timber."

Much space is also given in this report to the subject of Fungi on living plants, which are more disastrous to crops than the ravages of insects. These forms include rusts, smuts, mildews, rots, blights, etc., the rust alone on wheat taking from the former more than all the tax collectors, and creating such losses as to frighten cul tivators from their business. Professor Burrill regrets that the study of Fungi receives so little attention in this country, and says the number of American botanists who have published original accounts of the development of any fungous species may be counted on the fingers of one hand. As much practical importance and scientific interest is attached to such a study, we trust many botanists may in the future give more of their time to original investigations in this direction.

MICROSCOPY.

The American Monthly Microscopical Journal for October, describes a warm stage for the Microscope, by Professor E. H. Bartley. It has the advantage of being so simple that it can be constructed at home with a few inexpensive materials. We once saw this apparatus shown by the inventor at the New York Microscopical Society, and considered it a success.

Simple forms of mechanical figures are described by Mr. J. Sullivant.

Professor C. C. Merriman's interesting paper on the microscopical collections made by him in Florida, occupies nine pages of this number.

We regret that Mr. Frederick Habirshaw's "*Catalogue of the Diatomaceæ*" will be delayed in the publication for the want of sufficient promise of patronage. This may arise from many not understanding the nature of the work or its construction. If the editor of the *American Monthly Microscopical Journal*, who has the matter in hand, would print a sample page in his journal, it might remove such a difficulty. We believe we have heard the author himself state that the book in question would be useless to those not having a full library of works on the subject, so as to avail themselves of the ample references he makes to the published literature of the subject.

The demand for such a work must be very limited; on the other hand a condensation of all this literature would be very welcome. A comprehensive work on the diatomaceæ, well illustrated, is much wanted and if issued in monthly parts, at a moderate price, would command a fair sale both at home and abroad.

Mr. Habirshaw appears to have the material for such a work in his possession, and he has given ample proof of his literary ability to undertake the task.

We think ten dollars would be better invested in a work such as we suggest, than five dollars in an index to a scattered literature, which the purchaser can never hope to possess.

PHYSICAL NOTES.

Observation Made on a Group of Rays in the Solar Spectrum.—L. Thollon figures and describes a group of four rays, situate in the Orange. Two of these rays belong to Iron, their wave-lengths being respectively 5976·1 and 5974·6. The other two are Telluric, and their wave-lengths are 5976·35 and 5974·36.

Cause of the Variations of the Fixed Points of Thermometers.—J. M. Crafts cites some experiments which reduce to nothing, or almost so, the part played by pressure in the permanent elevation of the zero-point. The glass blown at the lamp and exposed for a long time to the action of heat diminishes in volume by means of some internal change, and it is not demonstrated that pressure plays any part whatever in the phenomenon. The particles of glass which have been removed asunder whilst it was being blown do not return immediately to their normal position at a lower temperature; we observe disturbances for some time, and finally the glass may remain for a long time in a state of tension at the ordinary temperature. The action of heat at a given temperature (*e.g.*, 355°), giving a greater mobility to the particles, favors their return to the normal position, and gives scope to a contraction. But the glass, when cooling from this latter temperature retains a part of the displacement peculiar to 355°. On heating again to a lower temperature (*e.g.*, 300°) a new decrease of volume is produced, so that a very slow cooling, which produces successively all these effects upon the particles of glass, must ensure the greatest stability.

Rapid Alcoholic Fermentation.—In order to effect rapid fermentation for the destruction of the sugar contained in wines, J. Bouissngault suggests that the sample be mixed with water and yeast, and placed in connection with an exhausting syringe, reduces the pressure, and thus which eliminates the alcohol as fast as formed. The fermentation, not being checked by its presence, goes on till all the sugar is decomposed.

Inconveniences, from a Physiological Point of View, of the Substitution of Amylic Alcohol for Ether in Stas's Process for the Detection of Morphine.—As amylic alcohol, even in very small doses, produces in animals systoms closely resembling narcotism, and as it is not readily removed from the cadaveric extract, physiological experimentation in confirmation of the chemical reactions of morphine is rendered untrustworthy.—*Compes Rendus.*

Influence of the Galvanic Current on Bacteria F. Cohn and B. Mendelsohn carried out their experiments to verify the assertion of Schiel, that the galvanic current prevented the development of Bacteria. The results were that a feeble current from one pair of elements had no perceptible effect; a current from two elements rendered the solution inactive at the positive pole; a current from five, continued for twenty-four hours, completely sterilized the whole solution, and deprived it of its power to infect another solution. The solution at the positive pole was first affected; with the stronger current the liquid became acid at the positive and alkaline at the negative pole. The induction current had no perceptible effect on the Bacteria.—*Jour. Chem. Soc.*

Effect of Age on the Quality of Iron.—Previous tests have shown that iron, subject to even fifty years of use and exposure, is not perceptibly changed in quality, either in strength or elasticity. Professor Thurston recently tested the remains of the Fairmount Suspension Bridge, which had been in use forty years, and found the iron in no manner deteriorated.

Phosphorescent Lighting.—Dr. Phipson takes Sulphide of Barium, or some other substance which is rendered phosphorescent by the solar rays, and encloses it in a Geissler tube, through which he passes a constant electric current of a feeble but regular intensity. He claims to obtain in this manner a uniform and agreeable light, at a lower cost than that of gas.

BOOKS RECEIVED.

Sugar Analysis—A Description of the Methods used in Estimating the Constituents. By M. Benjamin, Ph. B. New York. 1880.

To those who desire a concise and practical guide to this subject, Dr. Benjamin's essay, published in pamphlet form with twenty illustrations, will perhaps be more serviceable than a more elaborate work. The essential facts for a general comprehension of the subject have been judiciously arranged.

of the wood has long been known, its liability to 'winter-kill' and its irregular, crooked growth has prevented its being planted for timber."

Much space is also given in this report to the subject of Fungi on living plants, which are more disastrous to crops than the ravages of insects. These forms include rusts, smuts, mildews, rots, blights, etc., the rust alone on wheat taking from the former more than all the tax collectors, and creating such losses as to frighten cul tivators from their business. Professor Burrill regrets that the study of Fungi receives so little attention in this country, and says the number of American botanists who have published original accounts of the development of any fungous species may be counted on the fingers of one hand. As much practical importance and scientific interest is attached to such a study, we trust many botanists may in the future give more of their time to original investigations in this direction.

MICROSCOPY.

The American Monthly Microscopical Journal for October, describes a warm stage for the Microscope, by Professor E. H. Bartley. It has the advantage of being so simple that it can be constructed at home with a few inexpensive materials. We once saw this apparatus shown by the inventor at the New York Microscopical Society, and considered it a success.

Simple forms of mechanical figures are described by Mr. J. Sullivant.

Professor C. C. Merriman's interesting paper on the microscopical collections made by him in Florida, occupies nine pages of this number.

We regret that Mr. Frederick Habirshaw's "*Catalogue of the Diatomaceæ*" will be delayed in the publication for the want of sufficient promise of patronage. This may arise from many not understanding the nature of the work or its construction. If the editor of the *American Monthly Microscopical Journal,* who has the matter in hand, would print a sample page in his journal, it might remove such a difficulty. We believe we have heard the author himself state that the book in question would be useless to those not having a full library of works on the subject, so as to avail themselves of the ample references he makes to the published literature of the subject.

The demand for such a work must be very limited ; on the other hand a condensation of all this literature would be very welcome. A comprehensive work on the diatomaceæ, well illustrated, is much wanted and if issued in monthly parts, at a moderate price, would command a fair sale both at home and abroad.

Mr. Habirshaw appears to have the material for such a work in his possession, and he has given ample proof of his literary ability to undertake the task.

We think ten dollars would be better invested in a work such as we suggest, than five dollars in an index to a scattered literature, which the purchaser can never hope to possess.

PHYSICAL NOTES.

Observation Made on a Group of Rays in the Solar Spectrum.—L. Thollon figures and describes a group of four rays, situate in the Orange. Two of these rays belong to Iron, their wave-lengths being respectively 5976·1 and 5974·6. The other two are Telluric, and their wave-lengths are 5976·35 and 5974·36.

Cause of the Variations of the Fixed Points of Thermometers.—J. M. Crafts cites some experiments which reduce to nothing, or almost so, the part played by pressure in the permanent elevation of the zero-point. The glass blown at the lamp and exposed for a long time to the action of heat diminishes in volume by means of some internal change, and it is not demonstrated that pressure plays any part whatever in the phenomenon. The particles of glass which have been removed asunder whilst it was being blown do not return immediately to their normal position at a lower temperature ; we observe disturbances for some time, and finally the glass may remain for a long time in a state of tension at the ordinary temperature. The action of heat at a given temperature (*e.g.*, 355°), giving a greater mobility to the particles, favors their return to the normal position, and gives scope to a contraction. But the glass, when cooling from this latter temperature retains a part of the displacement peculiar to 355°. On heating again to a lower temperature (*e.g.*, 300°) a new decrease of volume is produced, so that a very slow cooling, which produces successively all these effects upon the particles of glass, must ensure the greatest stability.

Rapid Alcoholic Fermentation.—In order to effect rapid fermentation for the destruction of the sugar contained in wines, J. Bouissngault suggests that the sample be mixed with water and yeast, and placed in connection with an exhausting syringe, reduces the pressure, and thus which eliminates the alcohol as fast as formed. The fermentation, not being checked by its presence, goes on till all the sugar is decomposed.

Inconveniences, from a Physiological Point of View, of the Substitution of Amylic Alcohol for Ether in Stas's Process for the Detection of Morphine.—As amylic alcohol, even in very small doses, produces in animals systoms closely resembling narcotism, and as it is not readily removed from the cadaveric extract, physiological experimentation in confirmation of the chemical reactions of morphine is rendered untrustworthy.—*Compes Rendus.*

Influence of the Galvanic Current on Bacteria F. Cohn and B. Mendelsohn carried out their experiments to verify the assertion of Schiel, that the galvanic current prevented the development of Bacteria. The results were that a feeble current from one pair of elements had no perceptible effect ; a current from two elements rendered the solution inactive at the positive pole ; a current from five, continued for twenty-four hours, completely sterilized the whole solution, and deprived it of its power to infect another solution. The solution at the positive pole was first affected ; with the stronger current the liquid became acid at the positive and alkaline at the negative pole. The induction current had no perceptible effect on the Bacteria.—*Jour. Chem. Soc.*

Effect of Age on the Quality of Iron.—Previous tests have shown that iron, subject to even fifty years of use and exposure, is not perceptibly changed in quality, either in strength or elasticity. Professor Thurston recently tested the remains of the Fairmount Suspension Bridge, which had been in use forty years, and found the iron in no man ner deteriorated.

Phosphorescent Lighting.—Dr. Phipson takes Sulphide of Barium, or some other substance which is rendered phosphorescent by the solar rays, and encloses it in a Geissler tube, through which he passes a constant electric current of a feeble but regular intensity. He claims to obtain in this manner a uniform and agreeable light, at a lower cost than that of gas.

BOOKS RECEIVED.

Sugar Analysis—A Description of the Methods used in Estimating the Constituents. By M. Benjamin, Ph. B. New York. 1880.

To those who desire a concise and practical guide to this subject, Dr. Benjamin's essay, published in pamphlet form with twenty illustrations, will perhaps be more serviceable than a more elaborate work. The essential facts for a general comprehension of the subject have been judiciously arranged.

of the wood has long been known, its liability to 'winter-kill' and its irregular, crooked growth has prevented its being planted for timber."

Much space is also given in this report to the subject of Fungi on living plants, which are more disastrous to crops than the ravages of insects. These forms include rusts, smuts, mildews, rots, blights, etc., the rust alone on wheat taking from the former more than all the tax collectors, and creating such losses as to frighten cul tivators from their business. Professor Burrill regrets that the study of Fungi receives so little attention in this country, and says the number of American botanists who have published original accounts of the development of any fungous species may be counted on the fingers of one hand. As much practical importance and scientific interest is attached to such a study, we trust many botanists may in the future give more of their time to original investigations in this direction.

MICROSCOPY.

The American Monthly Microscopical Journal for October, describes a warm stage for the Microscope, by Professor E. H. Bartley. It has the advantage of being so simple that it can be constructed at home with a few inexpensive materials. We once saw this apparatus shown by the inventor at the New York Microscopical Society, and considered it a success.

Simple forms of mechanical figures are described by Mr. J. Sullivant.

Professor C. C. Merriman's interesting paper on the microscopical collections made by him in Florida, occupies nine pages of this number.

We regret that Mr. Frederick Habirshaw's "*Catalogue of the Diatomaceæ*" will be delayed in the publication for the want of sufficient promise of patronage. This may arise from many not understanding the nature of the work or its construction. If the editor of the *American Monthly Microscopical Journal*, who has the matter in hand, would print a sample page in his journal, it might remove such a difficulty. We believe we have heard the author himself state that the book in question would be useless to those not having a full library of works on the subject, so as to avail themselves of the ample references he makes to the published literature of the subject.

The demand for such a work must be very limited; on the other hand a condensation of all this literature would be very welcome. A comprehensive work on the diatomaceæ, well illustrated, is much wanted and if issued in monthly parts, at a moderate price, would command a fair sale both at home and abroad.

Mr. Habirshaw appears to have the material for such a work in his possession, and he has given ample proof of his literary ability to undertake the task.

We think ten dollars would be better invested in a work such as we suggest, than five dollars in an index to a scattered literature, which the purchaser can never hope to possess.

PHYSICAL NOTES.

OBSERVATION MADE ON A GROUP OF RAYS IN THE SOLAR SPECTRUM.—L. Thollon figures and describes a group of four rays, situate in the Orange. Two of these rays belong to Iron, their wave-lengths being respectively 5976·1 and 5974·6. The other two are Telluric, and their wave-lengths are 5976·35 and 5974·36.

CAUSE OF THE VARIATIONS OF THE FIXED POINTS OF THERMOMETERS.—J. M. Crafts cites some experiments which reduce to nothing, or almost so, the part played by pressure in the permanent elevation of the zero-point. The glass blown at the lamp and exposed for a long time to the action of heat diminishes in volume by means of some internal change, and it is not demonstrated that pressure plays any part whatever in the phenomenon. The particles of glass which have been removed asunder whilst it was being blown do not return immediately to their normal position at a lower temperature; we observe disturbances for some time, and finally the glass may remain for a long time in a state of tension at the ordinary temperature. The action of heat at a given temperature (*e.g.*, 355°), giving a greater mobility to the particles, favors their return to the normal position, and gives scope to a contraction. But the glass, when cooling from this latter temperature retains a part of the displacement peculiar to 355°. On heating again to a lower temperature (*e.g.*, 300°) a new decrease of volume is produced, so that a very slow cooling, which produces successively all these effects upon the particles of glass, must ensure the greatest stability.

RAPID ALCOHOLIC FERMENTATION.—In order to effect rapid fermentation for the destruction of the sugar contained in wines, J. Bouissngault suggests that the sample be mixed with water and yeast, and placed in connection with an exhausting syringe, reduces the pressure, and thus which eliminates the alcohol as fast as formed. The fermentation, not being checked by its presence, goes on till all the sugar is decomposed.

INCONVENIENCES, FROM A PHYSIOLOGICAL POINT OF VIEW, OF THE SUBSTITUTION OF AMYLIC ALCOHOL FOR ETHER IN STAS'S PROCESS FOR THE DETECTION OF MORPHINE.—As amylic alcohol, even in very small doses, produces in animals systoms closely resembling narcotism, and as it is not readily removed from the cadaveric extract, physiological experimentation in confirmation of the chemical reactions of morphine is rendered untrustworthy.—*Compes Rendus.*

INFLUENCE OF THE GALVANIC CURRENT ON BACTERIA F. Cohn and B. Mendelsohn carried out their experiments to verify the assertion of Schiel, that the galvanic current prevented the development of Bacteria. The results were that a feeble current from one pair of elements had no perceptible effect; a current from two elements rendered the solution inactive at the positive pole; a current from five, continued for twenty-four hours, completely sterilized the whole solution, and deprived it of its power to infect another solution. The solution at the positive pole was first affected; with the stronger current the liquid became acid at the positive and alkaline at the negative pole. The induction current had no perceptible effect on the Bacteria.—*Jour. Chem. Soc.*

EFFECT OF AGE ON THE QUALITY OF IRON.—Previous tests have shown that iron, subject to even fifty years of use and exposure, is not perceptibly changed in quality, either in strength or elasticity. Professor Thurston recently tested the remains of the Fairmount Suspension Bridge, which had been in use forty years, and found the iron in no manner deteriorated.

PHOSPHORESCENT LIGHTING.—Dr. Phipson takes Sulphide of Barium, or some other substance which is rendered phosphorescent by the solar rays, and encloses it in a Geissler tube, through which he passes a constant electric current of a feeble but regular intensity. He claims to obtain in this manner a uniform and agreeable light, at a lower cost than that of gas.

BOOKS RECEIVED.

SUGAR ANALYSIS—A DESCRIPTION OF THE METHODS USED IN ESTIMATING THE CONSTITUENTS. By M. Benjamin, Ph. B. New York. 1880.

To those who desire a concise and practical guide to this subject, Dr. Benjamin's essay, published in pamphlet form with twenty illustrations, will perhaps be more serviceable than a more elaborate work. The essential facts for a general comprehension of the subject have been judiciously arranged.